United States. Circuit Court. Southern District of New York

American Graphophone Co.)
versus) In Equity
Cleveland Walcutt, et al.) No 5966

DEFENDANTS' PAPERS IN OPPOSITION TO MOTION FOR PRELIMINARY INJUNCTION

1894-95

UNITED STATES CIRCUIT COURT,
Southern Districh of New York.

IN EQUITY

American Graphophone Co.

vs.

Cleveland Walcutt, et. al.

Defendants' papers in opposition to motion

for Preliminary Injunction

Dyer and Driscoll
Solicitors for Defendants

Richard N. Dyer,
Samuel O. Edmonds,
Of Consel.

C.G. Burgoyne, Walker and Centre Streets, N.Y.

United States Circuit Court,

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ors for Defendants

RICHARD N. DYER
SAMUEL O. EDMONDS,
Of Counsel.

C. G. Burr[illegible] and C[illegible] Brooklyn, N. Y.

INDEX.

(The following patents are bound in the end of the record in the following order :)

English Patents :

2909 of 1877 to Thomas A. Edison.
1644 " 1878 " " " "

United States Patents :

C. C. Reynolds, 287,166.
T. A. Edison, 382,462.
" " " 393,967.
" " " 393,968.
" " " 400,646.
" " " 414,761.
" " " 430,274.
" " " 430,278.
" " " 484,583.

United States Circuit Court,

SOUTHERN DISTRICT OF NEW YORK.

American Graphophone Company vs. Cleveland Walcutt et al.	In Equity.

Affidavit of Thomas A Edison.

State of New Jersey,
County of Essex, } ss.:

Thomas A. Edison, being duly sworn, deposes and says:

I have read the affidavits of the complainant for use on the motion for preliminary injunction, and believe that they fail to present a correct view of the situation. So far as I know, there has never been any recognition of the validity of the graphophone patents on which this suit was brought, nor has it ever been recognized that the matters set forth in those patents involve inventions of merit.

The attempt is made by these patents to cover the idea of producing the phonograph record by cutting in a solid substance, and particularly by cutting the record in a wax or wax-like material, which is stated in the patents to be a mixture of beeswax and paraffine. It is asserted that this feature made possible or created the modern phonograph. But that is not the fact. Aside from details in the construction of the machines, making them more covenient in use, which details are not employed in the phonograph, the machines described in these graphophone patents involve no advance in the art.

5 At the time of my original work upon the phonograph in 1877 and 1878, I used for the recording surface, not only tinfoil, which was pressed into a groove by the recording point, but I used various solid resisting materials in which the records were cut by the recording point. Among these latter materials were various waxes, including beeswax and paraffine and mixtures of the same, and also various metals and compositions and alloys of metals. My tinfoil phonograph, however, proved to be the best at that time for the particular
6 use which was made of it, namely, for a loud-sounding instrument which could be used for exhibition purposes without listening tubes. I not only used these solid resisting materials to form the record, but I used with them suitable sharp recording points—chisel-shape, knife-edge and otherwise--by which the materials were cut. The fact that I used such materials for the recording surface, and that in recording upon them the record was formed by the removal of the material, is shown by statements in my early patents and
7 caveats. In my English Patent No. 1644 of 1878, a copy of which is appended, the statement is made that the recording surface may be formed by coating paper or other materials with paraffine or other hydrocarbons, waxes, gums or lacs, and that this may be used itself to form the record, or that it may be covered by a sheet of thin metal foil. The fact that when I used the sheet without the metal foil, the wax was actually removed in the process of producing a record (as it must be, in fact, when the material is
8 free), is shown by the statement in the patent that, when the foil is placed over the wax, "the indenting point does not become clogged with the paraffine in consequence of the intervening foil." Similar statements appear in patents taken by me at about the same time in other countries, and also in various publications made about the same time, referring to my work and to my patents. The paraffine coating took the place when superimposed by the tinfoil of the grooved surface into which the tinfoil was

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pressed by the recording stylus when the foil was used alone, and consequently a sufficient body of paraffine was placed on the paper for that purpose. This is indicated by the statement in the English Patent that, in recording on the foil laid on paraffine, "the indentation can now be made in the foil and the paraffine." Hence there was a sufficient thickness of paraffine to receive the whole depth of the record, and when used without the covering of metal foil the record was made by ploughing a groove in the paraffine of greater or less depth, according to the movements of the recording style. The word "indentation" was used by me as descriptive of the waves of the resultant record, and not as indicative of the method of recording.

The use of wax and waxlike materials for receiving phonograph records which are cut in producing the record, was also proposed by various other persons, in 1878 and 1879, including Lambrigot, Cros and Cabonel. Lambrigot employed stearine, which is a waxlike material; Cros and Cabonel employed wax. These materials are necessarily cut or removed in recording upon them, and that without reference to the shape of the point of the recording style, but as a matter of fact the form of the recording style employed by me, and also by the other experimenters to whom I have referred, was such as to make it certain that the material was entirely removed in producing the record, and not removed to one side only. It is not possible to throw the material which must be removed to form the indentations, on one side of the line of the record, except in cases where a very soft, viscous material is used. In the case of the record cylinders at present employed with the phonograph, no record can be made that does not entirely remove the material, and that without regard to the form of the recording point, since any form of recording point that can be made to record at all will remove the material entirely, the only difference being that the power required in the case of a dull point is greater than with a sharp point. The knife

13 edge recording style is described in my first English patent No. 290.) of 1877 (copy appended).

The United States patent of Christopher C. Reynolds, granted October 23, 1883 (copy appended), is also significant in this respect. Reynolds, considering the tinfoil record of the ordinary phonograph not durable and not capable of being handled, proposed a phonograph operating to cut the record in hard materials. The special materials he mentions are certain metals, but he says, "These strips may be made of any
14 of the metals hereinbefore mentioned, or any durable material which will withstand the frictional wear and handling incident to their use." In order to secure the power necessary for cutting the record into hard materials while retaining a sensitive action of the recording diaphragm, he proposes to utilize the movement of the recording diaphragm to vibrate the recording surface against a cutter rotated by power, which cutter cuts the record.

In my early experiments, as set out in my English
15 patents of 1877 and 1878, I appreciated the desirability of a record in metals and other hard materials, and many methods of producing such records are described by those patents. I also set forth, among other plans of making records, the two plans (1) of causing the vibrations of the recording diaphragm to move the indenting point directly, and (2) of causing such vibrations to control and direct a force of greater energy which would itself produce the record. Thus in figure 4 of my first English patent, a knife-edge re-
16 cording style forms the record directly, while in figures 14 and 15 of that patent, the recording diaphragm gives form to a thread which by means of power rollers is pressed into the surface on which the record is made. In my second English patent, most of the forms of recorder act directly upon the recording surface, but in figure 50 the recording diaphragm is used to move a valve controlling a blast of air, which works with greater force upon a second diaphragm carrying the recording

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style. Hence, before this patent of Reynolds not only had metals, waxes and other materials been suggested as the recording surface, but it had also been suggested that the sound vibrations could be used to produce the record directly or to control more energetic means for producing that record. Reynolds adopted the second plan of making the record and developed a special machine in which the record surface would be moved with relation to a rotary cutter, the record being cut in solid material, for which purpose he prefers the metals, but mentions any other hard material. The graphophone patents in suit simply adopt the other old method of recording, namely, the operation of the recording style directly by the diaphragm, and apply that to the cutting of one of the old materials already known for the purpose. The form of cutter proposed by Reynolds which is not provided with teeth receives no advantage from the fact that it is arranged to rotate, and it might as well be stationary. With his smooth edge cutter, therefore, Reynolds simply moves the record against the cutter instead of moving the cutter against the record as is ordinarily done. The distinctions which the first of the two patents in suit attempts to draw over this Reynolds patent are not, it seems to me, valid distinctions, in view of what I had already disclosed by my patents.

The difficulty I had in the use of wax as a recording surface in 1877 and 1878 was that the point became clogged, as stated in my English patent of 1878. This was due to the softness of the wax employed. The mixture of beeswax and paraffine referred to in the patents in suit is subject to this same objection, and the graphophones which were first put upon the market employed a soft wax, such as is described in the patents in suit, and were highly objectionable for this and other reasons, and were not in any sense practical or commercial machines. The difficulties arising from clogging is recognized by the patents in suit, and in the [illegible] the machine provided with a brush [illegible] is designed to overcome this difficulty.

21 After 1878 I continued my experiments upon the phonograph to such an extent as my work in other directions permitted, and I used from time to time waxes and other forms of solid recording surfaces in which the record was cut. These experiments were almost constantly under way, in one form or another. The experiments which resulted in the perfected phonograph of to-day were begun as early as 1883.

The inference contained in the moving affidavits, that I did not renew my experiments upon this subject
22 until I heard of the graphophone, is not in accordance with the facts. It is probably true that when I learned of the graphophone I gave more time to the experiments on the phonograph and prosecuted them with greater vigor than I would otherwise have done, but I had then for some time been conducting experiments looking towards bringing out a commercial form of the phonograph, and had been using, among other things, waxes and compositions of waxes for the recording surface.

23 When the graphophone was placed upon the market, it was not a successful or commercial machine. The phonograph, which was placed upon the market at the same time, was a better machine than the graphophone, but was not, in my opinion, a commercial or successful machine. I had invested a considerable amount of money in the manufacture of the phonograph, and was under contract to deliver commercial machines, and after expending a large sum of money in the manufacture of phonographs, it became evident
24 that although the phonograph was better than the graphophone then upon the market, neither was a commercial machine, and the amount of money invested by myself and others in the business caused me to undertake an elaborate series of experiments to produce such a machine.

The principal difficulty with both the graphophone and the phonograph at that time was the failure to reproduce the hissing and labial sounds, which failure rendered the machines practically useless for commercial pur-

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poses because of the indistinct or unintelligible character of the record produced. I had experienced this same difficulty with the use of waxes in my early experiments, but I did not know the reason for the difficulty, and I had expected to overcome it by improvements in the mechanism of the machine. When, however, both the graphophone and phonograph proved to be commercial failures, I undertook the elaborate series of experiments referred to with a view of improving the phonograph and making it commercial. The real cause of the difficulty was not at that time known, either to myself or to anybody else, so far as I am aware. I conducted the experiments by modifying and improving the various details of the machine, and especially of the recording and reproducing devices and the parts immediately connected therewith. In the course of these experiments I also attempted to eliminate the scratching and other foreign sounds which were apparent in the reproduction of the records. I hoped by the elimination of these foreign sounds to better reproduce the sibilant sounds, and hence make the articulation clearer, and perhaps to reach the real trouble. In this line of experiments I tried and used hundreds of mixtures of waxes and waxlike materials, keeping several men constantly employed in preparing the compositions and molding the cylinders under my direction. The cylinders were tried by me personally in most instances on the machines. For nearly a year I carried on this line of experiments, confining myself largely to the recording and reproduction of certain critical words like "*ship*" and "*sugar*." Towards the end of the experiments I made some excessively hard wax compositions, much harder than anything which had been before tried, and I was much surprised, on trying them, to discover that the hissing and labial sounds were more clearly reproduced. I knew then that I had at last found the right principle, and that the perfection in articulation was largely, if not wholly, a function of the recording surface, i. e. the quality of the material, and not of the mechanism [illegible] by microscopic

and other investigation the correct theory upon the subject, which is, that with soft materials the minute elevations and depressions which represent the hissing and labial sounds have not sufficient strength to operate the reproducing diaphragm, but are smoothed out by the reproducing style, and that to give such minute elevations and depressions sufficient resisting power for that purpose an excessively hard material must be employed. And further that the material must be brittle and not viscous to prevent the distortion of the record. Having reached that conclusion and demonstrated its accuracy to my satisfaction, I proceeded in my search for still harder materials, and finally adopted soap, which is covered by my patent No. 430,274 (copy appended), and that material has remained to the present day the recording material for the phonograph.

Recently the Graphophone Company has greatly improved the graphophone by the use, either of cylinders made by the Edison Phonograph Works for the phonograph, the graphophones being provided with special tapering mandrels to receive them, or of cylinders made by the Graphophone Company in imitation of the phonograph cylinders and composed of an exceedingly hard material which I believe to be principally soap, such as is covered by my patent No. 430,274; and notwithstanding the fact that by its contracts the Graphophone Company obligated itself not to use any of the improvements upon the phonograph, or to alter the graphopone in the direction of utilizing any of the features of the phonograph, yet that company has been obliged, in order to make the graphophone at all commercial, to not only adopt the hard soap cylinders of the phonograph, but to adopt other features of the phonograph, such as the true cutting style of my patents Nos. 393,967 and 393,968, the sapphire recorder of my patent No. 484,583, the cup-shaped recording style and spherical reproducing style of my patent No. 430,278, the microscope glass diaphragm of

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my patent No. 400,646 (copies appended) and other devices invented and patented by me.

While the metallic soap, which is the recording material of the phonograph, is in a sense a waxlike material, yet due to the facts which I have stated, it clearly is not the scientific or practical equivalent of the composition of beeswax and paraffine referred to in the patents in suit.

The phonograph cylinders are not only made of soap, as stated in my patent No. 430,274, but they are also molded in one solid piece of that material, as stated in my patent No. 382,462 (copy appended), the material not being coated upon a foundation of paper or other similar material, and the special form of cylinder which I finally adopted is that having an internal rib in accordance with my patent No. 414,761 (copy appended). The features of these patents Nos. 382,462 and 414,761 are also used in record cylinders which have been recently introduced for use with the graphophone.

The use of a cylinder made wholly of a wax-like material is significant of the character of the cylinder, because when cylinders are made as described in the graphophone patents here in suit, by coating a paper tube with a wax surface, the wax must be soft, viscous and flexible; otherwise, when it cools after the coating is applied, it will crack, due to contraction, and it will also crack subsequently by expansion and contraction due to variations in temperature, because the coefficient of the expansion of wax is many times that of a material such as paper. I found, however, in my experiments that any waxlike material which is sufficiently hard to produce a successful phonographic record, cannot be coated upon paper or similar material, but must have substantially the same co-efficient of expansion throughout the cylinder in order to prevent cracking the material. This, although I did not know the reason at the time, was one of the difficulties I met with in my early experiments, the waxes I employed being coated upon a paper or similar backing

37 in most, if not in all, instances. The same difficulty is inherent in the cylinders which are described in the graphophone patents in suit. The use of a paper foundation makes it necessary that the wax coating be thin and relatively soft and flexible, in order to withstand the difference in the rate of expansion of the wax and the paper, and such is the coating described in those patents. Hard rubber has a rate of expansion several times greater than paper, and yet the hard wax-like materials which can be successfully employed
38 cannot be moulded upon it without cracking, since they have a still greater rate of expansion. The phonograph cylinders now in use, being made wholly of soap, are not destroyed by any change in temperature.

With regard to the recording tablet which is made the subject of the second graphophone patent here in suit, I wish to call attention to the fact that the phonograph cylinders are made of a soap, and and do not consist, as does the tablet in the graphophone patent, of a hollow cylinder or tube of paper or
39 other similar material upon which wax is coated, nor is the surface one made of a mixture of beeswax and paraffine. I wish also to call attention to the fact that various forms of recording surfaces, including rollers and cylinders, are described in my early patents, my English patent of 1878 stating that "the phonogram may be in the form of a disk, a sheet, an endless belt, a cylinder, a roller or a belt or strip."

A sample phonograph cylinder is submitted herewith; also a sample graphophone cylinder with the
40 coating on a paper tube; and also a sample graphophone cylinder made wholly of a hard waxlike material, which is lead soap, with internal ribs. The paper tube, with which this last cylinder is provided, is put into the cylinder after the latter is made. It performs no useful function, and is, in my opinion, used only to conceal the real character of the cylinder.

The failure of the graphophone of the patents in suit is further shown by the following facts: The graphophone and phonograph were introduced upon the

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market by the North American Phonograph Company 41
simultaneously and under contracts providing that customers should be allowed to select either machine. In this way a considerable number of phonographs and graphophones were introduced, but the graphophone began to be immediately thrown back upon the hands of the North American Phonograph Company until they were nearly, if not quite, all replaced by phonographs, and the North American Phonograph Company found it impossible to introduce the graphophone. Under Mr. Lippincott's contracts with the Grapho- 42
phone Company he bought a large number of graphophones, some three thousand as I now remember, and paid the Graphophone Company upwards of two hundred thousand dollars for the machines, but they were so worthless that these machines were eventually all shipped to the Edison Phonograph Works and were there thrown into scrap.

Another proof of the failure of the graphophone is furnished by the experience of the International Graphophone Company. That company purchased the 43
graphophone patents for England and other foreign countries, and undertook to do business with the machine described in those patents. Under a misunderstanding as to the practical character of the graphophone the International Company paid, as I have always understood, a large amount of money for the patent rights. It established a factory in this country, and began here the manufacture of graphophones for the foreign market. The business, however, was a failure. At that time I was ex- 44
hibiting through agents the phonograph in European cities, and, in order to save the loss of their entire investment, the International Company opened negotiations with me for rights under the graphophone patents. As a result of the negotiations a company called the Edison United Phonograph Company was formed, one-half of the capital stock of the United Company was paid for rights in the phonograph, the capital stock of the International Company being bought with the

45 other half, the factory already established in this country was given up, several hundred graphophones which had been manufactured, or partially manufactured, were sent to the Edison Phonograph Works at Orange, N. J., and there turned into scrap, involving a loss of many thousand dollars, and the United Company began to use phonographs manufactured by the Edison Phonograph Works, and has continued to use such phonographs exclusively down to the present time.

With regard to the arrangements with Mr. Lippin-
46 cott which are set up in the moving papers as constituting an acknowledgment of the validity of the graphophone patents, and of the merit and originality of the alleged inventions covered by said patents, I do not think that such arrangements furnish any warrant for the conclusion which is sought to be drawn from them. Mr. Lippincott was interested in the graphophone and had the exclusive right to exploit it. At the time he acquired those rights he did not know of my perfected phonograph, but soon after that time, I having opened
47 an office in New York City for the sale of machines, he saw my machine, and, recognizing its superiority over the graphophone, he desired to acquire the right to handle it. I had already made arrangements for the exploitation of the phonograph when Mr. Lippincott opened negotiations with me. He was obliged to secure the consent of the Graphophone Company on account of his contract obligations, and in his endeavor to secure a release from those contract obligations, he undertook to pay the Graphophone Company ten dollars a machine
48 upon each phonograph which he put into active use. I have always asserted and believed that the graphophone patents were invalid so far as they pretended to cover the features of the phonograph, and my understanding of Mr. Lippincott's negotiations with the Graphophone Company was that his arrangement to pay a royalty on the phonographs was purely a business compromise and had no relation to any question of the validity of the graphophone patents or of the infringement of such patents by the

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phonograph. It is my understanding, however, that 49
all phonographs at the present time on the market
and in the hands of users are machines upon which
Mr. Lippincott has either actually paid royalties or
which have been or should have been included in
royalty accounts rendered by the Graphophone Com-
pany against Mr. Lippincott before the date of his
assignment.

Further than this, all phonographs and all phono-
graph supplies now on the market were manufactured
and sold by the Edison Phonograph Works in accord- 50
ance with contracts by which the complainant the
American Graphophone Company acknowledged the
right of the Edison Phonograph Works to manufacture
and sell such instruments and supplies.

The contract situation is a complicated one, and in-
volves many documents as well as many agreements,
evidenced by the course of business in which the
American Graphophone Company acquiesced and from
which it profited. On August 1, 1888, an agreement
was entered into between myself, the North American 51
Phonograph Company and Jesse H. Lippincott, a copy
of which is hereto annexed, in which my right to manu-
facture phonograph and phonograph supplies is acknowl-
edged, and in which it is provided that the phonograph
and the graphophone (the latter called the "phono-
graph-graphophone), which were to be put upon the
market by the North American Phonograph Company,
should not be changed from standard models to which
the agreement refers by the incorporation in either in-
strument of any of the features of the other in such re- 52
spect as they then differed, and that in the future,
while I might improve the phonograph and the manu-
facturer of the graphophone might improve that instru-
ment, [illegible] should use the improvements of
the other, [illegible] patented invention of the
said Edison, assigned or assignable to the Company
hereunder, shall be used on or sold with the phono-
graph-graphophone, and no new patented invention
owned or controlled now or hereafter by the Volta

53 Graphophone Company shall be used upon or sold with the said phonograph." In other words, neither interest was to use the then patented or subsequently patented inventions of the other interest, except so far as they were then in use in the standard models to which the agreement refers. My interest in this contract was transferred to and operated under by the Edison Phonograph Works.

The standard phonograph which said contract refers to contained all the features of all subse-
54 quent phonographs, so far as there is or can be any claim of infringement under the graphophone patents here in suit. The phonograph has been changed from the model referred to in said contract only in strict compliance with the terms of the contract, by modifications which were inventions of my own, and which were not at the date of said contract, and have not since that time been patented by the graphophone interests. The standard graphophone referred to in said contract infringed several of my
55 patents, and especially my early patents upon the phonograph granted in 1878 and 1880. The graphophones subsequently manufactured, however, have not been made in compliance with said contract, but have been modified by the use of inventions patented later by me.

This contract of August 1, 1888, was acknowledged and confirmed by the American Graphophone Company, as evidenced by the course of business, and also by an agreement between the Graphophone Company
56 and Mr. Lippincott, dated August 6, 1888 (copy appended), the purpose of which was to ratify the various arrangements which Mr. Lippincott had already made, including the arrangements made by said contract of August 1, 1888.

The situation was investigated by Mr. Benjamin F. Thurston in the opinion which is referred to in the affidavit of Charles J. Bell given for the complainant in this case. Mr. Thurston summarizes the situation in the following language.

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pinion which is referred to in the
I. Bell given for the complainant in
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ge.

"The substance of the agreements with respect to 57
the phonograph and the graphophone, so far as relates to the rights of the North American Phonograph Company, may be summarized as follows: The title to the Edison phonograph patents resides in the Edison Phonograph Company. The title to the graphophone patents resides in the Volta Graphophone Company. The exclusive right to manufacture Edison phonographs under these patents resides in the Edison Phonograph Works. The exclusive right to manufacture graphophones is vested in the American Graphophone 58
Company. The exclusive right to use, lease and sell both the phonograph and the graphophone is vested in the North American Phonograph Company. The continuance of these rights depends upon the performance of the conditions of the several agreements upon which these rights are based. I have not felt it necessary to go through in detail these several agreements beyond stating their general effect."

The Edison Phonograph Works, which Mr. Thurston 59
refers to, is a corporation, a majority of whose capital stock is owned by me. The Edison Phonograph Company, referred to by Mr. Thurston, is likewise a corporation, and all of its capital stock is now owned by me. I have acquired the capital stock of the latter company by purchase since the North American Phonograph Company went into the hands of a receiver in August last. The ownership of my patents relating to phonographs and the right to manufacture under said patents, except so far as said right is affected by the contracts made with Mr. Lippincott, the 60
North American Phonograph Company and others, are now practically my personal property.

In conclusion, I wish to say that neither the phonograph nor the graphophone is, even to-day, notwithstanding the use in both of those instruments of inventions which I have made since they were put upon the market in 1888, a satisfactory commercial instrument for the use which the North American Phonograph Company expected to make of

those instruments, and upon which its large capitalization was based. That use was the replacement of the stenographer in commercial houses, in the work of professional men and the like. With both of these instruments the amount of matter which can be placed upon one record cylinder is limited to a running time of a few minutes. Further, and more important, is the fact that even with the approximately perfect articulation which I have succeeded in obtaining in the phonograph, the sounds are weak, and listening ear-tubes have to be employed. There are also numerous other defects which must be remedied. For these reasons the effort to introduce the most perfected phonographs for use by commercial and professional men for dictation purposes has been practically abandoned, and the present use of such instruments is almost wholly for amusement purposes in the reproduction of musical and other records. In 1877 and 1878, I believed that an instrument which would give a loud reproduction, audible throughout a room, was essential to thorough success, and I still believe so. The limited extent to which the phonograph has been introduced is largely due to the adoption of the business idea that an instrument which would have to be listened to with ear-tubes would have a certain extent of use. Had I cared to take advantage of that limited field in 1878, some of the instruments I then had would have been quite as satisfactory as were the first phonographs and graphophones put upon the market in 1888, but I was looking for a broader field—for that great and unquestionable success which when attained will make the phonograph one of the most useful and valuable of modern appliances. But that success has not yet been attained. I am, however, working in that direction, with every prospect of an early and favorable issue to my experiments, and I expect soon to put upon the market an instrument with which novels, plays and the finest classes of instrumental and vocal music can be rendered audible in a room, and which will give, when the

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and I am now working in that direction, with
pect of an early and favorable issue to my ex-
and I expect soon to put upon the market
ent with which novels, plays and the finest
nstrumental and vocal music can be rendered
a room, and which will give, when the

records are reproduced, the same quality and ap- 65
proximately the same volume of sound as the original
rendition.

THOMAS A. EDISON.

Subscribed and sworn to before me this 6th day of December, 1894.

T. H. SMITH,
Edison, N. J.,
Notary Public,
State of New Jersey. 66

[SEAL.]

67

68

69

AGREEMENT.

THOMAS A. EDISON

WITH

THE NORTH AMERICAN PHONOGRAPH COMPANY

AND

JESSE H. LIPPINCOTT.

70

AUGUST 1, 1888.

AGREEMENT, made this 1st day of August, 1888, by and between Thomas A. Edison, of Llewellyn Park, in the State of New Jersey, party of the first part, and the North American Phonograph Company, a corporation organized and existing under the laws of the State of New Jersey, and Jesse H. Lippincott, of the City and State of New York, parties of the second part.

71 WHEREAS, The party of the second part has been organized with the view of exploiting and introducing commercially the Phonograph and has acquired the necessary rights and authority so to do; and

WHEREAS, Jesse H. Lippincott has acquired the right to exploit and introduce an instrument known as the Graphophone; and

WHEREAS, The said company and the said Lippincott possessing the right to introduce both instruments, intend placing them upon the market together, leaving 72 to the public the right to make their own selection in buying or renting instruments.

NOW, IT IS AGREED AS FOLLOWS:

FIRST. The Phonograph shall be put on the market under the name of the Phonograph. The instrument now known as the Graphophone shall be put on the market under the name of the Phonograph-Graphophone. The said company and the said Lippincott shall do their utmost to introduce both instruments, and shall in no way press the introduction of one at the

REEMENT.

[AS A. EDISON

TH

MERICAN PHONOGRAPH

COMPANY

AND

H. LIPPINCOTT.

GUST 1, 1888.

his 1st day of August, 1888, by
A. Edison, of Llewellyn Park, in
ey, party of the first part, and the
nograph Company, a corporation
g under the laws of the State of
e H. Lippincott, of the City and
arties of the second part.

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authority so to do; and

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AS FOLLOWS:

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he Phonograph. The instrument
raphophone shall be put on the
ame of the Phonograph-Grapho-
ompany and the said Lippincott
t to introduce both instruments,
ress the introduction of one at the

expense of the other, nor permit or allow its officers, 73
agents or employees to favor one more that the other.

SECOND. The price to the public for either purchase or rental of each instrument complete, including one cylinder, means for driving the instrument, whether by electric motor, clock-work or foot power, or otherwise, shall be the same, provided that the selling price of each of said instruments to the public shall not be over one hundred dollars, or the rental shall not be over forty dollars per annum, and the discounts and commissions in selling or renting each shall be the same, 74
and each instrument shall be sold and rented on the same terms of payment.

THIRD. In order that no misunderstanding shall occur as to what is a Phonograph and what is a Phonograph-Graphophone, an instrument previously marked "Phonograph, T. A. Edison," and now in the possession of The North American Phonograph Company, is to be taken as a standard Phonograph; and an instrument previously marked "Phonograph-Graphophone, C. S. Tainter," and which is now in the possession of 75
T. A. Edison, is to be taken as a standard Phonograph-Graphophone. None of the parts or features of construction of one instrument shall be hereafter applied to or used on the other, but each shall remain as it now is, as illustrated by the instruments marked, except in so far as each may be improved by patented inventions, but any patented invention of Mr. Edison improving the Phonograph shall not be applied to or used on the Phonograph-Graphophone, nor shall any patented invention owned or controlled by the Volta Graphophone Company im- 76
proving the Phonograph-Graphophone, be applied to or used on the Phonograph, it being the intention hereof that each instrument shall remain distinct, and shall not be improved by the use of parts or features of construction of the other.

FOURTH. Any invention or improvement made by the said Edison within fifteen years from the date hereof upon the Phonograph, as it now exists, shall be assigned to the company without further compensation. But any

77 invention made by the said Edison, within fifteen years from the date hereof, relating to a special Phonograph or special extra for the Phonograph, which is sold as an extra, such as the manufacture of duplicate records of music, novels, &c., or any invention by which the use of the Phonograph is enlarged, or by which it is adapted to uses other than those for which it is now available, shall be assigned to the company, and the company shall pay to the said Edison a royalty of fifteen per cent., computed on the manufacturer's price
78 to the company of every special Phonograph, special extra, duplicate records or apparatus embodying the invention by which the use of the Phonograph is enlarged or by which it is adapted to uses other than those for which it is now available, as the case may be. Clocks to be exempted from all contracts. All patents issued on said invention shall belong to the company and all expenses of procuring the same shall be paid by it. No new patented invention of the said Edison assigned or assignable to the company hereunder shall be used on
79 or sold with the Phonograph-Graphophone, and no new patented invention owned or controlled, now or hereafter by the Volta Graphophone Company, shall be used upon or sold with the said Phonograph.

FIFTH. In order that the said Edison may conduct experiments looking towards the improvement of the Phonograph the company shall allow him to draw, for experimental expenses for the first year from the date hereof, fifteen thousand dollars; for the second, ten thousand dollars; for the third, seventy-five
80 hundred dollars, and yearly, for ten years thereafter, five thousand dollars. These expenses to be paid upon vouchers showing actual net cost, with no profit to the said Edison or any company in which he is interested.

SIXTH. If the company should, at any time, be sued or threatened with a suit by any person claiming that any part or feature of the Phonograph infringes patents issued to any person other than the said Edison, or upon any invention alleged to have been made by

by the said Edison, within fifteen years
ereof, relating to a special Phonograph
for the Phonograph, which is sold as an
ie manufacture of duplicate records of
&c., or any invention by which the use
raph is enlarged, or by which it is
s other than those for which it is now
be assigned to the company, and the
pay to the said Edison a royalty of fif-
computed on the manufacturer's price
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records or apparatus embodying the in-
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is adapted to uses other than those for
w available, as the case may be. Clocks
d from all contracts. All patents issued
ion shall belong to the company and all
rocuring the same shall be paid by it. No
invention of the said Edison assigned or
the company hereunder shall be used on
the Phonograph-Graphophone, and no
invention owned or controlled, now or
the Volta Graphophone Company, shall be
sold with the said Phonograph.
order that the said Edison may
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d dollars. These expenses to be paid
rs showing actual net cost, with no profit
Edison or any company in which he is in-

the company should, at any time, be sued
d with a suit by any person claiming that
feature of the Phonograph infringes pat-
o any person other than the said Edison,
invention alleged to have been made by

another, the said Edison shall have the right, by his own counsel and at the company's cost, to participate in the defense of such suit. 81

SEVENTH. The company shall not sell Phonographs for use in countries other than the United States and Canadas, nor interfere in any way with the foreign business of the said Edison. The said Edison is also to have the exclusive right in perpetuity to manufacture Phonographs and all supplies therefor for export.

EIGHTH. All Phonographs shall have placed upon them such marks, numbers, dates of patents as, in the opinion of counsel to be selected by Jesse H. Lippincott, may be necessary for the protection, under the law, of all the patents owned or controlled by the Edison Phonograph Company and the Volta Graphophone Company. 82

NINTH. This contract is predicated upon the assumption that all the provisions of a contract entered into between the said Edison and Jesse H. Lippincott, dated the 28th day of June, 1888, have been or will be carried out. In case the said Lippincott should fail to pay the said Edison the five hundred thousand dollars, as in said contract provided, this contract shall be null and void. 83

IN WITNESS WHEREOF, the parties have set their hands and seal the day and year first above written.

THOMAS A. EDISON. [L. S.]
JESSE H. LIPPINCOTT. [L. S.]

Witness as to Lippincott:
J. ADRIANCE BUSH.

THE NORTH AMERICAN PHONOGRAPH CO., 84
[SEAL.] JESSE H. LIPPINCOTT, Prest.
Attest:
GEO. H. FITZWILSON, Secy.

85

SUPPLEMENTAL AGREEMENT.

THE AMERICAN GRAPHOPHONE COMPANY

AND

86

JESSE H. LIPPINCOTT.

AUGUST 6, 1888.

SUPPLEMENTAL AGREEMENT made this sixth day of August, 1888, by and between The American Graphophone Company, a corporation duly organized under the laws of West Virginia, hereinafter referred to as "said American Company," of the first part, and Jesse H. Lippincott, of the City, County and State of New
87 York, of the second part.

WHEREAS, the said Lippincott desires to secure a modification of his agreement with said American Company, so as to enable him to handle the Phonograph as well as the Graphophone; and

WHEREAS, said American Company has agreed to said modification upon certain terms and conditions:

NOW, THEREFORE, it is agreed by and between said American Company and said Lippincott as follows:

1st. That the selling price of the Graphophone shall
88 not be over one hundred dollars ($100) without the consent of said American Company; but, should said selling price at any time be fixed at over one hundred dollars ($100), then the excess above that amount shall be equally divided between the said American Company and the said Lippincott.

2d. That the said Lippincott shall submit to Benjamin F. Thurston, of Providence, R. I., or such other counsel as the said American Company may approve, the question as to what marks, numbers and dates are to be placed upon the Phonographs manu-

PLEMENTAL AGREEMENT.

:RICAN GRAPHOPHONE COMPANY

AND

JESSE H. LIPPINCOTT.

AUGUST 6, 1888.

:NTAL AGREEMENT made this sixth day of
8, by and between The American Grapho-
pany, a corporation duly organized under
West Virginia, hereinafter referred to as
rican Company," of the first part, and Jesse
ott, of the City, County and State of New
e second part.

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n of his agreement with said American Com-
to enable him to handle the Phonograph as
Graphophone; and

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EREFORE, it is agreed by and between said
Company and said Lippincott as follows:

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t the said Lippincott shall submit to
F. Thurston, of Providence, R. I., or such
sel as the said American Company may ap-
question as to what marks, numbers and
to be placed upon the Phonographs manu-

factured for and sold or leased by the North American Phonograph Company or its sub-companies or agents, in order to comply with the law and recognize and protect the patents now or hereafter owned or controlled by the Volta Graphophone Company, and the said Volta Company shall have the right to submit in writing its claims in this regard to the said counsel, and such marks, numbers and dates as the said Thurston or counsel shall decide are necessary, shall thereupon be placed upon said phonographs. 89

3d. Should the said Lippincott adopt the plan of exclusively leasing said instruments, and at any time on and after December 31, 1889, the results of such plan of leasing shall be unsatisfactory to the said American Company, the said company may require the said Lippincott to give the public the option of either leasing or purchasing the said instruments, and the selling price thereafter shall not exceed one hundred dollars ($100) without the consent of the said American Company. 90

4th. The said Lippincott shall make no arrangements or contracts with his agents or sub-agents which shall be in any manner disadvantageous to the Graphophone, but he and they shall leave to the public the right to make their own selection. 91

5th. All the rights and patents acquired or to be acquired by said Lippincott or the North American Phonograph Company from Thomas A. Edison and from the Edison Phonograph Company and from the Edison Speaking Phonograph Company shall be so vested and preserved, and any agreement between the said Lippincott and the said North American Phonograph Company shall be so framed that in case the said American Company shall exercise its option to purchase the said rights and patents under its agreement with the said Lippincott, the title to the said rights and patents may be transferred to the said American Company or the Volta Graphophone Company, as the case may be, free from encumbrance or cloud. 92

6th. On each and every Phonograph sold or leased

93 by the said Lippincott or the said North American Phonograph Company, or by any sub-company or agent of the said Lippincott or the said company, the said Lippincott shall pay to the said American Company the sum of ten dollars ($10); and on all cylinders and supplies for the said Phonograph one-fourth of the difference between the cost of said cylinders and supplies to the said Lippincott or said North American Phonograph Company, and the price at which the same may be sold to the public. And if the said American
94 Company shall, under its option from the said Lippincott, purchase the rights and patents of the said Edison, then the said Lippincott shall pay to the said American Company on each and every phonograph so sold or leased as aforesaid twenty dollars ($20); and upon all cylinders and supplies one-half of the difference between the cost to the said Lippincott or said North American Phonograph Company, and the price at which they may be sold to the public, settlements to be made periodically, as provided by the con-
95 tract between the said Lippincott and said American Company relating to Graphophones and supplies.

7th. The said Lippincott shall allow and pay to said American Company for experimental expenses fifteen thousand dollars ($15,000) the first year, ten thousand dollars ($10,000) the second year, seven thousand five hundred dollars ($7,500) the third year, and five thousand dollars ($5,000) each year for the next ten years, these expenses to be the actual cost of making drawings, constructing
96 models and making experiments, but to include no profit to said American Company. All such payments to be made to said American Company monthly upon vouchers showing said actual cost.

8th. In the conduct of the business and in all circulars, cards and advertisements, there shall appear in connection with the name of the North American Phonograph Company, or any sub-company, agents or sub-agents, and as prominently the following: "And Jesse H. Lippincott, sole licensee of American Grapho-

Lippincott or the said North American Company, or by any sub-company or agent ippincott or the said company, the said hal pay to the said American Company en dollars ($10); and on all cylinders and the said Phonograph one-fourth of the tween the cost of said cylinders and sup- said Lippincott or said North American Company, and the price at which the same l to the public. And if the said American all, under its option from the said Lippin- se the rights and patents of the said Edi- e said Lippincott shall pay to the said ompany on each and every phonograph so ed as aforesaid twenty dollars ($20); and inders and supplies one-half of the differ- en the cost to the said Lippincott or American Phonograph Company, and the ich they may be sold to the public, settle- made periodically, as provided by the con- n the said Lippincott and said American elating to Graphophones and supplies.

said Lippincott shall allow and pay to said Company for experimental expenses fif- and dollars ($15,000) the first year, ten dollars ($10,000) the second year, seven five hundred dollars ($7,500) the third five thousand dollars ($5,000) each year next ten years, these expenses to al cost of making drawings, constructing l making experiments, but to include no id American Company. All such payments to said American Company monthly upon owing said actual cost.

he conduct of the business and in all circu- and advertisements, there shall appear in with the name of the North American Company, or any sub-company, agents or and as prominently the following: "And ppincott, sole licensee of American Grapho-

phone Company," and the Graphophone shall bear a plate with the following inscription and no other, unless said American Company shall approve or direct the same (the blanks, numbers and dates to be such numbers and dates of patents as said American Company shall deem necessary): 97

THE PHONOGRAPH-GRAPHOPHONE,
Manufactured by the
AMERICAN GRAPHOPHONE COMPANY
for 98
JESSE H. LIPPINCOTT, SOLE LICENSEE
under patents.
No.---------- dated----------
No.---------- dated----------
and the patents of
Charles Sumner Tainter,
No.---------- dated----------
No.---------- dated----------

9th. The sureties on the bond of the said Jesse H. Lippincott, to secure the contract heretofore made by him with the said American Company, shall endorse hereon their assent hereto and their agreement that nothing herein contained shall be taken or held to affect their liability upon the said bond, and this endorsement shall be made before this supplemental agreement shall become operative. 99

10th. This supplemental agreement is made upon the understanding that the agreements made by said Lippincott and the North American Phonograph Company and Thomas A. Edison shall be fully carried out and complied with by the parties thereto, and in the event of the failure of either of said parties to carry out said agreement, then this agreement shall be and become null and void, and all the provisions of the original agreement between said Lippincott and said American Company relative to forfeiture, disputes and termination shall apply to this agreement the same as if repeated herein. 100

101 In witness whereof, the said American Graphophone Company has executed these presents by the signature of its president, countersigned by its secretary, and affixing its corporate seal, and the said Lippincott has signed and sealed the same the day and year first above written.

Witness as to James G.
Payne and Austin Herr,
H. M. Payne.

102 James G. Payne,
(Seal of A. G. Co.) President of the American Graphophone Co.

Attest:
Austin Herr,
Secretary.

In presence of
Geo. H. Fitzwilson.

Jesse H. Lippincott. [seal].

103

[Endorsement:]

We, the sureties on the bond of Jesse H. Lippincott to the American Graphophone Company, hereby give our consent to the said Lippincott entering into this supplemental agreement, dated the sixth day of August, 1888, and nothing herein contained shall be taken or held to affect our liability upon the said bond.

Geo. I. Whitney. [seal.]
104 John Robinson. [seal.]

In presence of
F. L. Stephenson,
as to Geo. I. Whitney.
Geo. H. Fitzwilson,
as to John Robinson.

HEREOF, the said American Grapho-
has executed these presents by the
president, countersigned by its secre-
its corporate seal, and the said Lip-
sl and sealed the same the day and
written.
James G.
n Herr,
H. M. PAYNE.

JAMES G. PAYNE,
. Co.) President of the American
Graphophone Co.

ERR,
cret y.
f
ITZWILSON.
JESSE H. LIPPINCOTT. [SEAL].

[ENDORSEMENT:]

ies on the bond of Jesse H. Lippincott
Graphophone Company, hereby give
he said Lippincott entering into this
greement, dated the sixth day of Au-
l nothing herein contained shall be
affect our liability upon the said bond.
GEO. I. WHITNEY. [SEAL.]
JOHN ROBINSON. [SEAL.]

f
PHERSON,
Geo. I. Whitney.
FITZWILSON,
John Robinson.

105

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. CLEVELAND WALCUTT ET AL.,	In Equity.

106

Affidavit of George E. Tewksbury.

STATE OF NEW YORK, }
County of New York, } ss.:

GEORGE E. TEWKSBURY, being duly sworn, deposes and says as follows: I am thirty-six years of age, reside 107
at Newark, N. J., and am the secretary and treasurer of the United States Phonograph Company, whose place of business is located at Newark, N. J. The principal business of the company consists in providing the blank record cylinders of talking machines with musical and other records for exhibition purposes, and supplying such records to sellers and users of phonographs and graphophones. It has a larger business of this character than any other concern. It also deals in
talking machines and supplies therefor to a limited 108
extent, but has never manufactured either the instruments themselves or the supplies which go with them.

I have been connected with the talking machine business since the inception of the commercial business in 1888, and am well acquainted with the history of that business. I was interested in the Kansas Phonograph Company at the time of its organization in 1888, and conducted the negotiations which resulted in a license

109 to that company, under the patents here in suit, by the North American Phonograph Company, such license being dated November 15, 1888. Prior to that date, I spent considerable time in New York City, conducting the negotiations which resulted in that contract, and from as early as 1888, down to the signing of the Kansas contract, I was in frequent consultation with Mr. Jesse H. Lippincott and the various persons who were at that time interested in the talking machine business.

Prior to the organization of the North American
110 Phonograph Company, which was in July, 1888, Mr. Lippincott had made a contract with the complainant, the American Graphophone Company, the owners of the graphophone patents including the patents in suit, by which, as was represented and generally understood, he became the agent of the complainant company, and the exclusive licensee under its patents. He subsequently, with the consent of the Graphophone Company, made contracts with the owners of the Edison phonograph patents, whereby the business of ex-
111 ploiting both the phonograph and the graphophone was to be carried forward as a single business. He organized the North American Phonograph Company for the purpose of exploiting said business, transferred his rights to that company, and organized various local companies, and issued to them licenses by which they were given exclusive rights under the phonograph and graphophone patents, each in a limited territory. Upwards of thirty local companies were thus organized and licensed, with the knowledge and consent of
112 the complainant the Graphophone Company. These local companies paid large amounts for their rights, in cash and stock, and the profits arising from the business thus organized were participated in by the complainant company. The Kansas Company, for illustration, owned the rights for the State of Kansas and the Territory of New Mexico, and paid therefor $20,000 in cash and $62,000 of its capital stock. Similar amounts were paid by other companies. The New Jersey Phonograph Company, which was [illegible] February

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n Phonograph Company, such license
vember 15, 1888. Prior to that date, I
ble time in New York City, conducting
s which resulted in that contract, and
1888, down to the signing of the Kan-
was in frequent consultation with Mr.
ott and the various persons who were
rested in the talking machine business.
organization of the North American
mpany, which was in July, 1888, Mr.
made a contract with the complainant,
raphophone Company, the owners of
e patents including the patents in suit,
s represented and generally understood,
gent of the complainant company, and
censee under its patents. He subse-
e consent of the Graphophone Com-
tracts with the owners of the Edison
tents, whereby the business of ex-
the phonograph and the graphophone
d forward as a single business. He
North American Phonograph Company
of exploiting said business, transferred
t company, and organized various local
issued to them licenses by which they
usive rights under the phonograph and
tents, each in a limited territory. Up-
y local companies were thus organized
with the knowledge and consent of
t the Graphophone Company. These
paid large amounts for their rights,
k, and the profits arising from the busi-
ized were participated in by the com-
ny. The Kansas Company, for illustra-
rights for the State of Kansas and the
w Mexico, and paid therefor $20,000 in
of its capital stock. Similar amounts
other companies. The New Jersey
mpany, which was organized February

19, 1889, and had the exclusive rights for the State of 113
New Jersey, paid $50,000 in cash and $125,000 of its capital stock.

I attach hereto a copy of the license contract of the New Jersey Phonograph Company as showing the rights of that company, and as an example of the character of contract which the other local companies received.

These contracts were all made for a period of five years, with the privilege of extension, and were in all instances, so far as I am aware, extended to March 26, 114
1903, and are now in force. The licenses of the Kansas and New Jersey companies were, in fact, extended to the last-named date.

The business was first carried on by the local companies by renting the machines to users, but subsequently, and in accordance with the contracts, the local companies were given the right to sell machines and supplies to the public.

The phonographs now owned by the United States Phonograph Company and used by that company to 115
make musical records were purchased by the United States Phonograph Company from the New Jersey Phonograph Company, and are used by the former company with the knowledge and consent of the latter company in the territory which is covered by the contract between the latter company and the North American Phonograph Company. All phonographs which the United States Phonograph Company has ever purchased and sold, and all blank record cylinders which it has ever purchased and used or sold 116
have been purchased from one or the other of the local or sub-companies having licenses under the patents in suit similar to the license of the New Jersey Phonograph Company.

During the carrying on of the business of the United States Phonograph Company, Mr. Emerson and myself, as officers of that Company, have been brought into very frequent contact with Edward D. Easton, of Washington, who is the vice-president and general

117 manager of the American Graphophone Company, and also president of the Columbia Phonograph Company, which latter is one of the local companies which acquired territorial rights from the North American Company, in the same manner as in the case of the Kansas and New Jersey Companies. Said Easton is practically the manager of both said Graphophone Company and said Columbia Company. He is largely interested in both, and the interests of the two companies are understood to be practically identical. He has known of
118 the operations of the United States Phonograph Company ever since its organization, has dealt with it very largely in the purchase of phonograph records, and never, until recently, has he seriously intimated or suggested that our business was carried on without proper authority, or that the machines licensed to be used and sold by the New Jersey Company, and which we obtained from that Company as stated, were in violation of any rights held by the American Graphophone Company, of which, as I have said, he is an officer;
119 or that the licensed use of said machines did not include the right and license to make, use and sell musical and other records on blank cylinders, which right constitutes the essentially useful element of such machines.

On the contrary, for a long time past, said Easton has very frequently visited our laboratory, and his two companies, the American Company and the Columbia Company, have been among our largest customers. Said Easton has during this period aided and encour-
120 aged us by suggestions and in many other ways in the carrying on of our business, and under such encouragement we have established a very large trade.

It is untrue, as stated in the affidavit of Charles J. Bell, verified October 9th, 1894, that the claims of novelty, originality and merit in the graphophone patents here in suit have never been seriously disputed. On the contrary, I believe these subjects to have been always in dispute; certainly this has been the case for the last several years during which I have been con-

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nected with this industry. Mr. Edison has been and is 121
regarded all over the world as having originated the only commercially successful phonograph. This is generally conceded and is regarded as beyond dispute. Until a short time ago the American Graphophone Company was utterly unable to place upon the market a graphophone capable of accomplishing commercial and useful results. The machine which they are at present putting upon the market overcomes the difficulties heretofore experienced only so far as it employs the practical
features of the phonograph which they have adapted to 122
the graphophone. This, as I have intimated above, is the feeling prevalent among those connected with this business, and the fact that the graphophone is incapable of practical commercial use is demonstrated by the fact that at the present time there are comparatively few graphophones in use, while phonographs in large numbers have been sold all over the world.

Until very recently it has been conceded by the officers of the Graphophone Company that the graphophone was not an operative and successful device. At 123
the Second Annual Convention of Local Phonograph Companies of the United States, held in New York in June, 1891, James G. Payne, then president of the American Graphophone Company, was called upon for an address to the Convention upon the subject of the commercial sound recording and reproducing device, and at the conclusion of this address, on being asked by a member of the Convention as to whether or not the Graphophone Company had a new machine or were about to make such a machine, he replied as fol- 124
lows:

"I want to say on that point that we have quite a number of graphophones at our factory and recognize the justice of some of the complaints that have been made about them, and are trying to improve them. We have men at work at Bridgeport now, both on the graphophone and on the cylinder, and if it becomes a necessity for us to take the field, as it may possibly be, we propose to have a machine that we can offer to

125 local companies or to agents with some assurance of success."

Although the phonograph has been upon the market for a number of years past, it has only been within the last year or so that the American Graphophone Company, by absorbing in its machine various features of the phonograph as aforesaid, has been able to place upon the market a device such as Col. Payne referred to as a machine that can be offered "to local companies or agents with some assurance of success." One of the
126 leading difficulties which precluded the successful operation of the graphophone prior to this time was that it employed a recording cylinder of soft, waxy material. This cylinder and the recording and reproducing styles used in connection therewith were incapable of performing their respective offices satisfactorily. Not only was it impossible to record and reproduce the hissing and labial sounds, but said styles, which were constructed of steel, were rapidly worn down or dulled, and in addition were so injuriously affected by the moisture both in
127 the recording medium and in the atmosphere that within a very short time after they were put into use they became unserviceable, and the machine, therefore, utterly impractical for recording and reproducing music.

In the spring of 1893, recognizing the manifest advantages of the phonograph, the American Graphophone Company commenced employing in its machines cylinders made by the Edison Phonograph Works, and supplied, I understand, by the North American Phono-
128 graph Company to the Columbia Phonograph Company under its license. These cylinders were turned over to the American Graphophone Company by the Columbia Phonograph Company. At the same time the graphophones were provided with tapering mandrels adapted to receive phonograph cylinders, and all graphophones sold to-day, so far as I know, have such mandrels. After putting these Edison cylinders into use upon their graphophones, they made the corresponding changes in the recording and reproducing devices,

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adapting such as had for some time been used in the 129
phonograph. It is true that for over a year last past, the American Graphophone Company has carried on experiments with a view to manufacturing a blank for the graphophone capable of the use to which the blank of the phonograph is put, but, so far as I am aware, they have not been successful. During my dealings, as an officer of the United States Company, with said Edward D. Easton and the American Graphophone Company, these cylinders have been regarded as incapable of practical use for making musical and other 130
exhibition records, for the reason that in the most approved form the action of the atmosphere upon the blanks was to cause a bluish-white incrustation or mold to appear upon the surface, which soon destroyed the perfection of the record. This difficulty with the Graphophone Company's cylinders has been recognized and conceded by said Company and its vice-president, Easton.

In the spring of the present year said Easton, acting for the Columbia Company and the American Grapho- 131
phone Company, submitted a proposition to furnish us with one thousand of these objectionable cylinders, which were referred to as "blue blanks," with the understanding that we were to provide such blanks with suitable musical and other records and return them to him, charging a certain sum for our work. After considerable negotiation, we finally accepted the proposition on the understanding prompted by our knowledge of the impracticable nature of the blanks that if such blanks proved a failure and would not properly perform 132
their office we should return them to the Columbia Company, which was to make the loss good. We thereupon proceeded with the work of providing these graphophone blanks with musical and other records, but found that they were a failure. On notifying Easton to this effect, he suggested that we allow them to stand for some time, having in view that they would improve with age. The following letter written on May 11th, 1894, by the United States Company to the

133 Columbia Phonograph Company illustrates our position in this connection :

" We are reluctantly compelled to cancel our arrangement with you in so far as it relates to the acceptance of Graphophone blanks in part payment. We will leave the price as we agreed, and we do not think that you can consistently ask us to accept a product *which we know to be inferior and detrimental to our trade.* We have now worked up all the blanks received from the Graphophone people, except the 11 returned
134 for your inspection.

" We appreciate your anxiety to put us right in this matter by your instructions that we should return all records made on Graphophone blanks not found satisfactory. We to-day ship you 140 orchestras. *We find the Graphophone blanks get worse with age instead of bettering*, and this of itself should indicate to you that there is *something wrong in the composition or its preparation.*"

In acknowledgment of this letter, Mr. Easton wrote,
135 on May 12, 1894:

" Until further advised, we will, if agreeable, continue our record arrangement, giving you Edison blanks."

Thus, as late as May of the present year, the American Graphophone Company acknowledged its inability to devise a practical record blank for the graphophone.

As illustrating earlier efforts made to devise blanks equal to the Edison product, the American Grapho-
136 phone Company, in 1893, obtained from us for the purpose of making these cylinders a quantity of what we termed "scrap wax," and which consisted of fragments of Edison cylinders which had been broken during the process of providing them with records. This "scrap wax" was forwarded by us to the Bridgeport factory of the said Graphophone Company, and there, I am informed and believe, was made up into new cylinders.

The inability of the American Graphophone Company to supply a practical and commercial blank for

ia Phonograph Company illustrates our position
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ability of the American Graphophone Com-
supply a practical and commercial blank for

use upon either the phonograph or graphophne con- 137
tinues to the present day. It is not even now capable of supplying the trade, and, therefore, to preclude the users of these machines from employing the Edison blanks would practically throw the whole talking machine enterprise to the ground.

GEORGE E. TEWKSBURY.

Subscribed and sworn to before me this 6th day of December, 1894.

EUGENE CONRAN, 138
[SEAL.] Notary Public,
Kings & N. Y. Counties.

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Exhibit License Contract Between North American Co. and New Jersey Co.

THIS AGREEMENT, made this Nineteenth day of February, A. D. 1889, by and between The North American Phonograph Company, a corporation duly organized under the laws of the State of New Jersey, owning or controlling certain patents of the United States of America and the Canadas, for inventions of Thomas A.
142 Edison, appertaining to what is known as the Phonograph and Speaking Phonograph, and acting under authority of, and agreement with, Jesse H. Lippincott, sole licensee of the American Graphophone Company, a corporation duly organized under the laws of the State of West Virginia, controlling certain patents of the United States of America for inventions of Alexander Graham Bell, Chichester A. Bell and Charles Sumner Tainter, appertaining to what is known as the Graphophone, lessor and licensor, party of the first
143 part, and The New Jersey Phonograph Company, a corporation duly organized under the laws of the State of New Jersey, lessee and licensee, party of the second part, WITNESSETH:

WHEREAS, the lessor and licensor, party of the first part, owns or controls, or has the right to use, the Letters Patent of the United States granted to Thomas Alva Edison and numbered as follows: 200,521, 201,760, 213,554, 227,679, 382,414, 382,416, 382,417, 382,418, 382,419, 382,462, 386,974, respectively, and the
144 inventions covered thereby, and owns or controls, or has the exclusive right to use in the United States and Canadas and may hereafter own or control or have the exclusive right to use in the United States and Canadas other inventions of Thomas Alva Edison, which are or may be embodied in or applicable to Phonographs or Phonographic appliances; and

WHEREAS, the lessor and licensor, party of the first part, acting under authority of and agreement with Jesse H. Lippincott, sole licensee of the American

License Contract Between North rican Co. and New Jersey Co.

EEMENT, made this Nineteenth day of Feb- . 1[illegible]9, by and between The North American Company, a corporation duly organized aws of the State of New Jersey, owning or certain patents of the United States of d the Canadas, for inventions of Thomas A. pertaining to what is known as the Phono- Speaking Phonograph, and acting under f, and agreement with, Jesse H. Lippincott, e of the American Graphophone Company, on duly organized under the laws of the est Virginia, controlling certain patents of d States of America for inventions of Graham Bell, Chichester A. Bell and Charles inter, appertaining to what is known as the me, lessor and licensor, party of the first The New Jersey Phonograph Company, a duly organized under the laws of the State sey, lessee and licensee, party of the second

ESSETH :

s, the lessor and licensor, party of the first or controls, or has the right to use, the Letters the United States granted to Thomas Alva d numbered as follows : 200,521, 201,760, 27,679, 382,414, 382,416, 382,417, 382,418, 382,462, 386,974, respectively, and the covered thereby, and owns or controls, exclusive right to use in the United States das and may hereafter own or control or exclusive right to use in the United States as other inventions of Thomas Alva Edison, or may be embodied in or applicable to phs or Phonographic appliances; and

s, the lessor and licensor, party of the first g under authority of and agreement with Lippincott, sole licensee of the American

Graphophone Company, has the exclusive right to use or let or sell to others to use in the United States the inventions covered by the Letters Patent of the United States granted to Alexander Graham Bell, Chichester A. Bell, and Sumner Tainter, numbered 341,212, 341,213, and the Letters Patent of the United States granted to Chichester A. Bell and Sumner Tainter, numbered 341,214, and the Letters Patent of the United States granted to Sumner Tainter, numbered 341,287, 341,288, and the Letters Patent of the United States granted to Charles Sumner Tainter numbered 374,133, 375,579, 380,535, respectively, and owns or has the right use, and may hereafter own or have the right to use, other inventions which are or may be embodied in or applicable to the Graphophone and Graphophonic appliances, which is to be hereafter known and described and designated as the Phonograph-Graphophone, and desires to extend the use of Phonographs and Phonograph-Graphophones leased and licensed by it, and of appliances therefor under and pursuant to the grant of the exclusive rights to the party of the second part herein contained; and

WHEREAS, the lessee and licensee, party of the second part, desires to obtain such exclusive rights to the use of Phonographs and Phonograph-Graphophones, and for the use of appliances therefor, under lease and license from the lessor and licensor, party of the first part, and to use and sublet the said instruments, and to use, sell and dispose of appliances therefor within the territory hereinafter described under and pursuant to the terms, restrictions and provisions hereinafter set forth.

NOW, THEREFORE, for and in consideration of the sum of Fifty thousand dollars, to be paid to the party of first part by the party of the second part, the receipt of which is hereby acknowledged, and for other good and valuable considerations, and in consideration of the covenants and agreements herein contained, and the rental herein agreed to be paid, it is agreed by and between the parties hereto as follows :

149 FIRST. The rights hereby granted shall remain in force, and this agreement shall continue until the 19th day of February, A. D. 1894, and for such further period as hereinafter provided, unless sooner terminated as hereinafter provided, and shall extend and exist and be exercised and the instruments and property leased hereunder shall be used only within the following described territory, namely, the State of New Jersey, U. S. A. And the party of the first part hereby covenants and agrees that it will grant no other similar rights or
150 any rights for the use of the Phonograph or Phonograph-Graphophone, or Phonographic or Phonograph-Graphophone appliances, for the foregoing territory, or any part thereof, while this agreement shall remain in force.

SECOND. The instrument which has been heretofore known or designated as the "Graphophone" shall at all times and in all dealings, advertisements, agreements and business of the party of the second part be known, designated and described as the "Phonograph-
151 Graphophone," and the instrument heretofore known or designated as the "Phonograph" shall continue to be so known, designated and described. In dealing with the public and sub-lessees, the party of the second part shall, and will, at all times offer and show both instruments together with absolute impartiality, leaving the person or persons with whom it is dealing to make his or their own selection, and the party of the second part, its officers, agents and employees shall in no way press the introduction of one instrument at the
152 expense of the other, and the commissions or remuneration to agents, if any shall be employed, shall be the same on each instrument.

THIRD. The party of the second part admits the validity of all patents relating to Phonographs, Phonograph-Graphophones and appliances therefor, now held, or which may hereafter be held, by the party of the first part, or under which it may hold licenses exclusive in their character, or under which its business may be conducted, and the validity of its rights under

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part, or under which it may hold licenses ex-
ve in their character, or under which its business
be conducted, and the validity of its rights under

or title thereto, and will not dispute the same, or make 153
use of, or be interested in, or cause others to make use
of or be interested in, any Phonographs or Phono-
graph-Graphophones or appliances therefor, or any in-
strument of a similar kind not leased, licensed or
authorized by the party of the first part or its assigns.
Provided, however, that the party of the second part
may manufacture or be interested in the manufacture
and sale of such phonographic or phonograph-grapho-
phonic appliances as may be approved of in writing by
the party of the first part; provided, however, that no 154
such authority shall be construed to apply to the manu-
facture of any articles, the right to manufacture which
is now, or may hereafter be, vested in the American
Graphophone Company or in the Edison Phonograph
Company of New Jersey, or in the Edison Phonograph
Works, pursuant to the several agreements now exist-
ing between the above-mentioned parties, or either of
them, and The North American Phonograph Company
and Jesse H. Lippincott, sole licensee of the American
Graphophone Company, or either of them. 155

Fourth. The party of the first part, at the places
where Phonographs or Phonograph-Graphophones
are manufactured or from its depot of supplies situate
nearest to the general office of the party of the second
part, will deliver to the party of the second part Phono-
graphs and Phonograph-Graphophones and supplies
therefor, made and to be used under the patents and
rights herein described during the continuance of this
agreement, and as herein set forth and permitted, and
all Phonographs and Phonograph-Graphophones and 156
supplies therefor delivered to the party of the second
part during the continuance of this agreement shall be
deemed to be furnished hereunder. Each of said
Phonographs and Phonograph-Graphophones so de-
livered shall remain the property of the party of the
first part, and is and shall be hereby leased and the
use of it licensed by the party of the first part under
said patents, and authority aforesaid now acquired or
which may hereafter be acquired, from the date of such

delivery, upon condition and so long as the rental therefor shall be duly paid to the party of the first part as herein provided, and so long as the provisions hereof are not violated, but not longer or otherwise, and subject to the terms of this agreement, the party of the second part may sublet or make sale of said instruments, as hereinafter provided.

FIFTH. The party of the second part shall pay and hereby agrees to pay to the party of the first part a a rental at the rate of twenty dollars per year on and for each and every Phonograph, and on and for each and every Phonograph-Graphophone delivered to it, payable in equal quarterly payments in advance, said rental to commence for each Phonograph or Phonograph-Graphophone on the first day of the first calendar month after its shipment by the party of the first part, and shall cease when and continue until the instrument so leased shall be returned into the possession of the party of the first part, and a notice by the party of the second part to the party of the first part of ten days in writing to its general office in the City of New York of its intention to deliver the said Phonograph or Phonograph-Graphophone, shall be considered as a return and delivery of the same into the possession of the party of the first part. And said rental shall cease also whenever proof shall be given satisfactory to the party of the first part of the destruction of the same by fire or other accident beyond the control of the party of the second part.

SIXTH. The party of the second part may sublet the Phonographs and Phonograph-Graphophones leased to it by the party of the first part under this agreement, but such subletting shall be subject to the restrictions and provisions of this agreement applicable thereto, and shall be under a sub-lease or agreement in writing the form of which shall be approved by the party of the first part, and each and every such sub-lease or agreement shall expressly set forth that the Phonograph or Phonograph-Graphophone so sublet is the property of the party of

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form of which shall be approved
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orth that the Phonograph or Phonograph-
s so sublet is the property of the party of

the first part, and that the same is leased and licensed 161
under the provisions of this agreement, and not other-
wise. And no such sub-lease shall be made for any period
less than three months. For each instrument sublet
the party of the second part shall charge the sub-lessee
rental at the rate of forty dollars per annum (neither
more nor less), payable in equal quarterly payments in
advance.

SEVENTH. The party of the second part shall keep
all instruments leased to it under this agreement in
good working condition, and to that end shall keep in 162
its employ a sufficient number of persons living at
different points in its territory, who, while acting as
agents or solicitors for the party of the second part,
shall have sufficient knowledge of the instruments to
enable them to remedy any slight defect in the working
thereof. But, whenever any part of an instrument shall
wear out from ordinary wear and tear by actual and
legitimate use, it shall upon its return to the party of
the first part be replaced by a new part free of charge
by the party of the first part. When any part shall be 163
broken or rendered ineffective by the carelessness or
neglect of the party of the second part or its sub-
lessee, the same shall be replaced at the expense of the
party of the second part, or of its sub-lessee.

EIGHTH. The party of the first part will, dur-
ing the continuance of this agreement and the
leases thereunder furnish to the party of the second
part after requisition by it, all such extra cylinders for
use on instruments leased, and "Special Extras," such
as records of music, orations, novels or other appli- 164
ances and parts of instruments applicable thereto,
which shall be sold by the party of the second part at
prices which shall be fixed from time to time by the
party of the first part. Such prices shall be uniform
in the case of each sub-company acting under the au-
thority of The North American Phonograph Company
or of Jesse H. Lippincott, sole licensee of the Ameri-
can Graphophone Company, and the party of the sec-
ond part shall, and it hereby agrees to, pay the party

of the first part for all extra cylinders, "Special Extras," parts and appliances so furnished, prices which shall be fixed at twenty per cent. less than the prices at which the same shall be sold by the party of the second part to others, payments to be made by the party of the second part to the party of the first part, on the 10th day of each month for all such cylinders, "Special Extras," parts and appliances delivered during the previous month.

NINTH. The party of the second part shall give immediate information and notice to the party of the first part whenever said party of the second part shall know that any one in its territory is using an instrument or any appliances thereof or therefor, which shall be an infringement of the patents or rights owned or controlled by the party of the first part, and upon receipt of such information the party of the first part will at its own expense at once institute legal proceedings or cause them to be instituted for the protection of the patents or rights owned or controlled by it.

And the party of the first part agrees at its own expense to defend the party of the second part against all suits for infringement by reason of the possession, leasing, use or sale of said instruments, supplies or appliances, and to pay all final judgments rendered in such suits, provided the party of the first part shall have notice of such suit and opportunity to defend the same, such notice to be given in time to allow the party of the first part to make answer, plea or other appropriate defense to the original bill, petition, complaint or other original pleading, and to defend through any counsel of its own selection. And the party of the second part shall not be at liberty to defend any such suit or legal proceedings on its own behalf until the party of the first part shall have refused so to do upon demand.

And the party of the first part further agrees that it will protect, indemnify and save harmless the party of the second part by reason of any damages or expenses which it may suffer, incur or sustain, growing out of any proceedings at law or in equity, or any litigation

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sand appliances so furnished, prices which shall
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efend the party of the second part against all
ifringement by reason of the possession, leas-
sale of said instruments, supplies or ap-
and to pay all final judgments rendered in
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e of such suit and opportunity to defend the
notice to be given in time to allow the party
part to make answer, plea or other appro-
to the original bill, petition, complaint
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hall not be at liberty to defend any such suit
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art shall have refused so to do upon demand.
party of the first part further agrees that it
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part by reason of any damages or expenses
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edings at law or in equity, or any litigation

which may be brought against, or which may injuriously affect the party of the second part in the quiet title to or possession or enjoyment of the rights and interests hereby granted, or intended to be granted, provided the party of the first part shall have opportunity to defend, as aforesaid, any suit or proceeding brought against the party of the second part.

TENTH. If, on the first day of January, 1890, or at any time thereafter, there shall be in any portion of the territory covered by this agreement a demand for Phonographs or Phonograph-Graphophones, Special Extras or appliances, which the party of the second part shall neglect or fail to take appropriate measures to meet, the party of the first part may give written notice thereof to the party of the second part, and if, at the expiration of thirty days thereafter, the said neglect or omission still continues, the party of the first part may, so long as such default shall continue, but to the extent only of such default, proceed to supply the demand through agents or otherwise without liability to the party of the second part, provided that course shall not interfere with the delivery to the party of the second part of instruments, special extras, or appliances for which requisition shall be made by it under the terms of this agreement.

But it is expressly understood and agreed that if at any time after one year from the date of this agreement The North American Phonograph Company shall be unable or shall fail to deliver to the party of the second part instruments and supplies for which said party of the second part shall have made due requisition upon the party of the first part as such requisition is provided to be made in the case of the Phonograph-Graphophone by Jesse H. Lippincott upon the American Graphophone Company pursuant to the agreement between said Lippincott and said American Graphophone Company under agreement dated March 26, 1888, and in the case of the Phonograph as provided, it shall be made by the Edison Phonograph Company upon

Thomas A. Edison, pursuant to the agreement of October 28, 1887, or by The North American Phonograph Company upon said Thomas A. Edison Phonograph Works, pursuant to the agreement of August 1st, 1888, and subject in the case of the Phonograph and Phonograph-Graphophone to the several terms of said agreements affecting such neglect or failure to supply either of said instruments, then the party of the second part shall have the right which the said North American Phonograph Company, or Jesse H. Lippincott, sole licensee of the American Graphophone Company, would then have to manufacture or cause to be manufactured instruments or supplies, or both, necessary to fill so much of such requisition as the said North American Phonograph Company or Jesse H. Lippincott, sole licensee of the American Graphophone Company, shall be unable or shall fail to supply, and all costs of said instruments or supplies to the party of the second part over and above the cost thereof as determined by the rentals of phonographs or phonograph-Graphophones or the prices of special extras and appliances, as herein provided, to the party of the second part, shall be borne by the party of the first part.

ELEVENTH. If, on the first day of January, 1890, or at any time thereafter, the results of exclusively leasing instruments shall be unsatisfactory to the party of the first part, it may require the party of the second part to give the public the option of either leasing or purchasing the said instruments, and in such event sales shall be made at such reasonable prices which shall be fixed by the party of the first part, provided, however, that if such requirement shall be made in the case of any one sub-company, it shall be operative in the case of all sub companies acting under the authority of The North American Phonograph Company, or of Jesse H. Lippincott, sole licensee of the American Graphophone Company. From the price received for any instrument so sold, there shall be first deducted and paid to the party of the first part an amount which shall equal the actual cost of said instrument to the party of the first

A. Edison, pursuant to the agreement of Octo-
1887, or by The North American Phonograph
y upon said Thomas A. Edison Phonograph
pursuant to the agreement of August 1st, 1888,
ject in the case of the Phonograph and Phono-
raphophone to the several terms of said agree-
ffecting such neglect or failure to supply either
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ve the right which the said North American
aph Company, or Jesse H. Lippincott, sole
of the American Graphophone Company, would
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merican Phonograph Company, or of Jesse H.
tt, sole licensee of the American Graphophone
. From the price received for any instrument
he so shall be first deducted and paid to the
the first part an amount which shall equal the
st of said instrument to the party of the first

part, and the remainder of such selling price shall be 177
equally divided between the party of the first part and the party of the second part, settlements and payments to be made by the party of the second part on or before the 10th day of each month for all sales made during the previous month.

TWELFTH. In the conduct of its business, and in all circulars, cards and advertisements, there shall appear, and the party of the second part shall set forth, as prominently as its own corporate name and in r connection therewith wherever it shall occur, the fol- 178
lowing: "Acting under authority of The North American Phonograph Company, and Jesse H. Lippincott, sole licensee of the American Graphophone Company."

THIRTEENTH. The party of the first part having made liberal provisions for conducting experiments looking towards the improvement and perfection of the Phonograph and Phonograph-Graphophones by the respective inventors thereof during the next fifteen years or thereabouts, will be entitled to the ownership, use or control of whatever inventions are made and patented 179
by such inventors, and the instruments leased or to be leased under this agreement shall have the benefit of all improvements and inventions thus secured; and any other improvements and inventions which the party of the first part may become entitled to the use, ownership or control of during the term of this agreement or any extension or renewal thereof, but it is expressly understood and agreed that no new patented invention of the said Edison shall be used or sold with the Phonograph-Graphophone, and no new patented 180
invention owned or controlled now or hereafter by the Volta Graphophone Company shall be used upon or sold with the Phonograph.

The instruments delivered by the party of the first part under this agreement shall at all times possess all the improvements thereon, which, at the time of such delivery, or prior thereto, have been adopted by the party of the first part. And it is further provided that, if the furnishing of such new

improvements or inventions shall add materially to the cost of the Phonograph or Phonograph-Graphophone, as the same is now known, the question of such additional charge, if any, shall be left to an arbitration, the party of the first part choosing one arbitrator, and the party of the second part another, and the two, if they fail to agree, a third, to be chosen by the two arbitrators, and the decision of such arbitration, or of a majority thereof, thus made, shall be binding upon the parties hereto.

FOURTEENTH. If the party of the second part shall fail to pay to the party of the first part any sum or sums of money which may be due under this agreement, and if said default shall continue for the period of thirty days after the same shall have become payable, and after written demand therefor, or if the party of the second part shall violate any other of the terms or conditions of this agreement, and shall persist in such default, violation or neglect, or fail to remedy or repair the same for sixty days after written notice thereof from the party of the first part, or if the party of the second part shall become bankrupt or insolvent, and shall so continue for the period of thirty days, then the party of the first part may, if it shall so elect, by written notice to the party of the second part (or those in charge of any of its offices), immediately terminate all the rights granted by the party of the first part hereunder, and take possession of and remove all Phonographs and Phonograph-Graphophones, and supplies therefor, and for that purpose may enter the premises of the party of the second part, and of all persons claiming under it, and may collect from any sub-lessee or purchaser all sums then or thereafter due to it or to the party of the second part for the use or purchase of any instruments, or for supplies therefor; or it may, so long as it shall see fit, leave in the enjoyment and use of any Phonograph or Phonograph-Graphophone, any lessee or other person in actual possession thereof, or by or from whom any part of the purchase price is unpaid, and collect from him or them

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the first part choosing one arbitrator, and the
the second part another, and the two, if they
gree, a third, to be chosen by the two arbitrators,
decision of such arbitration, or of a majority
thus made, shall be binding upon the parties

EENTH. If the party of the second part shall
y to the party of the first part any sum or
money which may be due under this agree-
d if said default shall continue for the period
days after the same shall have become paya-
after written demand therefor, or if the party
cond part shall violate any other of the terms
ions of this agreement, and shall persist in
ult, violation or neglect, or fail to remedy or
e same for sixty days after written notice
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part hereunder, and take possession of and re-
Phonographs and Phonograph-Graphophones,
lies therefor, and for that purpose may enter
ises of the party of the second part, and of all
claiming under it, and may collect from any
or purchaser all sums then or thereafter due
the party of the second part for the use or
of any instruments, or for supplies therefor;
so long as it shall see fit, leave in the enjoy-
l use of any Phonograph or Phonograph-
one, any lessee or other person in actual pos-
of, or by or from whom any part of the
price is unpaid, and collect from him or them

such sums as may then and thereafter be or become due 185
for the use or purchase of the Phonograph or Phonograph-Graphophone, and for that purpose shall be entitled to and may take possession of the premises of the party of the second part used for carrying on its business, and occupy and conduct the same. The property so taken, and which does not belong to the party of the first part or revert to it hereunder, may be returned within six months from the taking, in which case the party of the first part shall pay to the party of the second part a reasonable compensation for its use, or the 186
party of the first part may retain the same as its own property and pay therefor a reasonable price (not exceeding the actual cost thereof) within seven months after the taking, and shall account to the party of the second part for all the sums collected which shall have accrued before the party of the first part became so entitled to possession, deducting all expenses incident thereto, and all sums which may be due to the party of the first past. The party of the first part also expressly reserves to itself all its rights and remedies at 187
law and in equity under the patent laws or otherwise, including the remedy by injunction against the party of the second part, or those claiming under it, for the use of any of its patented inventions or instruments not authorized by a subsisting license hereunder, or for the violation of any other of its rights. The party of the first part may, in such event, at its own cost and expense, also use the name of the party of the second part to protect its interests and to enforce its rights hereunder. And the said party of the 188
second part hereby agrees to execute any and all assignments in accordance herewith, and in furtherance of the rights of the party of the first part under this paragraph.

FIFTEENTH. The party of the second part further agrees that simultaneously with the execution of this agreement, it will deposit One hundred and twenty-five thousand dollars par value of its full paid and unassessable capital stock, that is to say: Twelve hun-

dred and fifty shares of said stock, of the par value of One hundred dollars each share, with such Trust Company in the City of New York as may be approved by the party of the first part for delivery to said The North American Phonograph Company, party of the first part, or to Jesse H. Lippincott, Trustee, or his successor, as the party of the first party may direct, at the expiration of five years from the date of this agreement. That in the event of such deposit and upon due notice in writing to the party of the second part of such deposit of said shares with said Trust Company as aforesaid, the party of the first part shall forthwith deliver to the said Trust Company a license to the party of the second part, similar in form to the license herein granted, for a further period from the expiration of five years from the date of this agreement, viz., until the 26th day of March, 1903, and for such further time, at the option of the party of the second part, as the party of the first part may be authorized to extend said license. The deposit of said shares of capital stock and said extended license to be upon the following conditions: That at the expiration of said five years from the date of this agreement the said Trust Company shall deliver to The North American Phonograph Company, party of the first part, or to the said Jesse H. Lippincott, Trustee, or his successor, as the party of the first part may direct, said Twelve hundred and fifty shares of stock, and said Trust Company shall deliver to the party of the second part, its successors or assigns, the said extended license or the party of the second part shall be immediately entitled to the possession of the said extended license on the delivery as aforesaid of said Twelve hundred and fifty shares of stock. Upon the deposit of such shares of stock with said Trust Company and the depositing of said extended license as aforesaid, said The North American Phonograph Company, party of the first part, or Jesse H. Lippincott, Trustee, or his successor, as the case may be, shall agree with the party of the second part that neither it nor he will dispose of the said

d and fifty shares of said stock, of the par value of e hundred dollars each share, with such Trust Com- ny in the City of New York as may be approved by party of the first part for delivery to said The rth American Phonograph Company, party of the first rt, or to Jesse H. Lippincott, Trustee, or his succes- , as the party of the first party may direct, at the piration of five years from the date of this reement. That in the event of such deposit and on due notice in writing to the party of the second rt of such deposit of said shares with said Trust mpany as aforesaid, the party of the first part shall thwith deliver to the said Trust Company a license the party of the second part, similar in form to the ense herein granted, for a further period from the pir tion of five years from the date of this agree- nt, viz., until the 26th day of March, 1903, and for ch further time, at the option of the party of the cond part, as the party of the first part may be thorized to extend said license. The deposit of said ares of capital stock and said extended license to be on the following conditions : That at the expiration said five years from the date of this agreement the id Trust Company shall deliver to The North Amer- n Phonograph Company, party of the first part, or the said Jesse H. Lippincott, Trustee, or his cessor, as the party of the first part may direct, said velve hundred and fifty shares of stock, and said ust Company shall deliver to the party of the second rt, its successors or assigns, the said extended license the party of the second part shall be immediately titled to the possession of the said extended license the delivery as aforesaid of said Twelve hundred and ty shares of stock. Upon the deposit of such shares stock with said Trust Company and the depositing said exten[illegible] license as aforesaid, said The North erican Phonograph Company, party of the first part, Jesse H. Lippincott, Trustee, or his successor, as the se may be, shall agree with the party of the second rt that neither it nor he will dispose of the said

shares of stock during the said five years, or of any in- 193
terest therein, and that all dividends which may be earned and declared and paid upon said Twelve hundred and fifty shares of stock during the said five years shall be repaid to the party of the second part.

And the party of the second part further covenants and agrees that if at any time hereafter it shall increase its capital stock beyond the present fixed capitalization of Six hundred and twenty-five thousand dollars, it will, immediately upon said increase, deliver to the party of the first part, or to Jesse H. Lippincott, Trus- 194
tee, or his successor, as the party of the first part may direct, full paid capital stock of said Company to the extent of twenty-five per cent. of any such increase, provided, however, that if such increase shall be made prior to February 19th, 1894, then that the amount of such increase stock so delivered shall be non-participating as to dividends until said February 19th, 1894, as hereinbefore provided in respect to said Twelve hundred and fifty shares of stock.

SIXTEENTH. This contract is personal to the party of 195
the second part herein named, and any assignment of it, or of any of its rights granted hereunder, or any or either of them, by act of the party of the second without the written consent of the party of the first part, shall be a violation of this agreement, and good and sufficient ground for a cancellation thereof by the party of the first part at its option.

SEVENTEENTH. If the party of the first part shall transfer to any party, parties or corporation, who shall agree to perform the stipulations hereof, its title to the 196
Phonographs and Phonograph-Graphophones hereby leased and the patent rights under which they are licensed, and its then existing interests hereunder, it is agreed that the provisions hereof shall inure to the benefit of, and shall be binding upon, such transferee in respect of all things done or to be done under this agreement as if the transferee were named a party hereto; but the party of the first part, said The North American Phonograph Company, shall not be released

197 from its obligations hereunder, but shall continue to be answerable hereunder to the party of the second part pursuant to the terms of this agreement, as if such transfer had not been made.

EIGHTEENTH. The party of the first part hereby covenants for itself and its assigns with the party of the second part that it, the party of the first part, is, at the date hereof, fully and lawfully entitled and empowered to make and perform this agreement and license, and every part thereof, and that it will, on demand,
198 from time to time execute and deliver to the party of the second part all such further or other instruments of assurance as the party of the second part shall reasonably require.

NINETEENTH. The party of the second part hereby further agrees that it will keep its books of account, sales book, records of rentals and other office records in such form and will make such reports to the party of the first part as may be prescribed and directed by the party of the first part through its
199 auditor appointed for the purpose of organizing and maintaining a general form of records and accounts for all sub-companies.

TWENTIETH. It is hereby understood and agreed that the use of the Phonograph and Phonograph-Graphophone, so far as the same or either of them is applicable to watches, clocks, speaking figures, dolls or toys of any description, or in so far as the use thereof has been conveyed by the said Edison to Lowell C. Briggs and William W. Jacques, under and pursuant to a
200 certain agreement bearing date the first day of October, 1887, is hereby excepted and reserved from the terms of this agreement, and that this agreement shall not be construed as in any way authorizing the party of the second part to use the invention covered hereby for such purposes.

But it is further understood and agreed that Fifty per cent. of the profits which may be received by the party of the first part, or by Jesse H. Lippincott, Sole Licensee of the American Graphophone Company,

om its obligations hereunder, but shall continue to be
swerable hereunder to the party of the second part
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nably require.

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Licensee of the American Graphophone Company,

from or by reason of the use of the Phonograph 201
and Phonograph-Graphophone, or either of them, so far as the same are applicable to watches, clocks, speaking figures, dolls or toys of any description or by reason of the rights conveyed by said Edison to Lowell C. Briggs and William W. Jacques, as aforesaid, shall be divided, in such equitable way as may hereafter be determined, among all the sub-companies licensed by the party of the first part.

TWENTY-FIRST. The party of the first part further agrees that any and all privileges and powers not 202
herein conferred upon the party of the second part, which shall hereafter at any time during the continuance of this agreement be conferred by the party of the first part upon any other sub-company, shall be likewise granted to the party of the second part.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed, each by its proper officers, and each has caused its corporate seal to be affixed the day and year first above written.

THE NORTH AMERICAN PHONOGRAPH CO., 203
[SEAL.] By JESSE H. LIPPINCOTT,
Prest.

Attest:
GEO. H. FITZWILSON,
Secy.

NEW JERSEY PHONOGRAPH COMPANY,
[SEAL.] By G. G. FRELINGHUYSEN,
President.

Attest:
HOWARD W. HAYES, 204
Secy.

205

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. 206 CLEVELAND WALCUTT.	In Equity.

Affidavit of Thomas R. Lombard.

STATE OF ILLINOIS, }
County of Cook, } ss.:

THOMAS R. LOMBARD, being duly sworn, deposes and says as follows:

207 I am 46 years of age, reside at Chicago, Illinois, and am vice-president of the "Financier."

I was connected with the North American Phonograph Company up to May 1st, 1894, having been an officer of said Company since its organization. Prior to the organization of the North American Phonograph Company I was intimately associated with Mr. Jesse H. Lippincott in his graphophone enterprise. I am acquainted with all the negotiations relating to the handling of the graphophone and phonograph between 208 Mr. Lippincott and the owners of the patents on the graphophone and phonograph, and I am also acquainted with the history of the introduction of these instruments upon the market.

I am informed that it is asserted by the Graphophone Company that Mr. Lippincott paid the Graphophone Company a royalty on phonographs as a license under the graphophone patents, and that such payments furnish an acknowledgement of the validity of the graphophone patents and of the infringement of

D STATES CIRCUIT COURT,

HE[N] DISTRICT OF NEW YORK.

APHOPHONE COMPANY VS. AND WALCUTT.	In Equity.

t of Thomas R. Lombard.

OIS,
K, } ss.:

OMBARD, being duly sworn, deposes and

of age, reside at Chicago, Illinois, and
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that it is asserted by the Graphophone
r. Lippincott paid the Graphophone
ty on phonographs as a license under
patents, and that such payments
owledgement of the validity of the
tents and of the infringement of

them by the phonograph. From my knowledge of the 209
history of the negotiations between Mr. Lippincott and the Graphophone interest, I am able to say that this view of the situation is without foundation in fact. Mr. Lippincott was bound by a contract for the introduction of the graphophone exclusively, and was prohibited by that contract from handling any other talking machine. Subsequent to the date of that contract he made arrangement with the phonograph interest for the handling of that machine. Prior to making those arrangements, it became necessary for him to obtain 210
the consent of the Graphophone Company, and the officers of the Graphophone Company objected that for every phonograph which Mr. Lippincott should sell or put into active use they might lose the profit on a graphophone, whereas under their contract with Mr. Lippincott, they were entitled to the benefit of all his energies in that direction. As a compromise measure, therefore, and without any reference to the patent situtation, but wholly because of his contract obligations, Mr. Lippincott agreed to pay the Graphophone Com- 211
pany ten dollars on every phonograph which he put out, and it was on that basis that the business of the North American Phonograph Company was organized.

THOS. R. LOMBARD.

Subscribed and sworn to before me, this 5th day of December, 1894.

CHARLES LOUGHRIDGE,
[NOTARIAL SEAL.] Notary Public.

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213

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. 214 CLEVLAND WALCUTT ET AL.	In Equity.

Affidavit of Eben G. Dodge.

STATE OF NEW YORK, }
County of New York, } ss.:

EBEN G. DODGE, being duly sworn, deposes and says as follows:

215 I am a resident of Orange, N. J., and am employed at the Edison Phonograph Works at said Orange. I have been so employed since about the middle of September, 1894.

I have been familiar with phonographs and graphophones, generally, since about January, 1889. At this time I was in the employ of the American Graphophone Company, the complainant herein, and remained in this employ until August, 1889. I then entered the employ of the International Graphophone Company,
216 and in their interest attended the Paris Exposition until November of said year. From early in the year 1890, until some time during the summer of that year, I was employed as expert by the Eastern Pennsylvania Phonograph Company at Philadelphia. From the summer of 1890, until November of that year, I was employed at the works of the Edison Phonograph Company at Orange, N. J., my duties there being the assembling of the various parts of phonographs. Thereafter, for about two years, I was employed as superin-

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ATES CIRCUIT COURT,

DISTRICT OF NEW YORK.

IONE COMPANY

In Equity.

UTT ET AL.

of Eben G. Dodge.

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being located in New York City, and having charge of the business of the Company at that place. Thereafter—that is to say, in the month of November, 1892, I was again employed by the American Graphophone Company at Washington in the capacity of salesman. I remained in this employ about one month, and then went to Bridgeport in the same employ, for the purpose of carrying on experimental work at the factory of the Graphophone Company at that place. In January, 1893, while still in the employ of said Grapho- 218
phone Company, I took charge of the branch office of that Company in New York, and remained in this position until April 12, 1893, having charge of the introduction of graphophones in the said city of New York. From April 12, 1893, until some time in May, 1894, I was again engaged at the Bridgeport factory of the American Graphophone Company in the way of experimenting upon cylinders for use in connection with the graphophone.

At the time that I commenced my experiments at 219
Bridgeport on graphophone cylinders—that is to say, on or about April 12, 1893, the American Graphophone Company had in use and on sale a single type of cylinder for the recording and reproduction of sound. This cylinder was composed of a paper tube, coated with a thin, flexible and soft layer of ozokerite wax. In some instances this wax contained an admixture of paraffine.

The graphophones in connection with which these cylinders were used were found decidedly objectionable by users for various reasons, among which were, that 220
the wax with which the paper tube was coated was quite soft, and owing to this the point of the recording style was dulled, probably from impurities in the ozokerite; and that, also, owing to the use of the soft wax, the material was not cut sharply from the groove, but was permitted to tear, under the action of the style, whereby the record groove was made rough, and this conduced to a confusion of the articulate sounds. Added to this the

221 material clogged up the style, thus increasing the confusion of the sounds. Another objection, and one found very important in the use of these cylinders, was that, owing to the softness of the material, the minute elevations and depressions in the sound groove were readily leveled off by the action of the reproducer passing thereover; that is to say, the material did not have sufficient stiffness to withstand the rubbing action of the reproducer as it passed through the groove for the purpose of reproducing sound from the record
222 therein. Furthermore, with these cylinders it was impossible to record and intelligibly reproduce the hissing sounds so common in speech. These objections were well recognized and understood at the time I refer to, and experiments were carried on continuously for the purpose of avoiding them.

As an expert in this art I devoted a considerable time to the study of these objections, and to considering various modes of improving the apparatus having the said objections in view, and to this end I was sent
223 by the Graphophone Company to its Bridgeport factory, where I conducted a line of experiments in connection with wax cylinders, which led eventually to the soft cylinders or ozokerite cylinders above referred to being discarded and superseded by heavier cylinders composed of very much harder material, consisting principally of metallic soap. Previous to the time that I took up this work, however, the experiments had been carried on by Thomas H. MacDonald, the factory manager and superintendent of the Graphophone Com-
224 pany, at its Bridgeport factory. Mr. MacDonald had the same theory that I had concerning the improvement of the graphophone so as to avoid the difficulties above mentioned; indeed, Mr. Easton, who was made general manager of the company on or about the first of May, 1893, also recognized the fact that the soft cylinders were decidedly impracticable, because, very shortly after his assuming that position, he, to a great extent, caused these soft cylinders to be discarded, employing in their

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I understood, from the Edison Phonograph Works for the use of the Columbia Phonograph Company, of which said Easton was at that time president. At the present time, according to my information and belief, very few, if any, of the soft ozokerite wax cylinders are being placed upon the market by the Graphophone Company. The phonograph cylinders, that is to say, cylinders made by the Edison Phonograph Works for use upon phonographs, and hard metallic soap cylinders, the manufacture of which has comparatively re- 226
cently been taken up by the Graphophone Company, have almost, if not entirely, superseded the said ozokerite cylinders.

The hard cylinders referred to as being made by the Graphophone Company are of two types, but made of the same composition. One of these, known as the "P-cylinder," is in appearance the exact counterpart of the cylinder manufactured by the Edison Phonograph Works. Indeed, immediately after their construction, it would be difficult, if not impossible, to tell one of 227
these "P-cylinders" from an Edison cylinder without testing them on a machine. Like the latter, the Graphophone Company cylinder is of metallic soap, it is of the same dimensions and it is even provided with the internal screw-thread peculiar to the Edison cylinder.

The other type manufactured by the Graphophone Company is also of metallic soap, and is known as the "E-cylinder." It is longer and considerably thicker to permit it to be shaved down to remove 228
a record. It is mounted upon a pasteboard tube, which gives it somewhat the appearance of the old ozokerite cylinder. This tube, however, is not coated with the material, but, on the contrary, the material is moulded on a die, and the tube, after being provided with an external coating of shellac, is placed within the moulded cylinder. It was found necessary to do this for the following reason: It is absolutely impossible to mould the recording surface upon a pasteboard tube, owing to the expansion and contraction of the

229 former being considerably greater than that of the said tube. That is to say, were a coating of wax or metallic soap moulded upon the pasteboard tube the contraction of such material would be so much in excess of the contraction of the tube that the surface of the material would crack, while if the recording material were considerably thicker the differing coefficients of expansion would cause either the cylinder to crack or else the internal pasteboard tube to wrinkle or buckle.

I have before me one of the cylinders last referred
230 to, and for the purpose of identification have marked the same "Defendants' Exhibit Graphophone E-Cylinder E. G. D." During the process of moulding the exhibit cylinder, it is provided upon its interior with a screw-thread of great pitch, and when the paper tube is inserted it is secured by means of the shellac to this thread, which forms internal ribs. The object of this mode of attachment is to guard against the cracking of the cylinders. If the cylinder had a continuous bearing upon the exterior of the paper tube throughout its
231 length, the contraction of the wax or soap, which is infinitely greater than that of the paper, would cause the cylinder to crack; whereas, by reason of the bearing surface of the said cylinder upon the paper tube being in form of a screw-thread of great pitch, provision is made for the contraction of that portion of the cylinder opposite one of the internal threads or ribs. Even this provision is practicable only to a certain extent, for these cylinders, which average three-eighths of an inch, and are adapted to be shaved down,
232 will only remain intact after being reduced about one-half. After such reduction in size, the cylinder has not sufficient stability to withstand temperature changes and the wear incident to its use. This is true not only where the cylinder has, after use, been reduced in size, but applies equally where the cylinder is originally turned down to the reduced size. In addition to the objections which I have heretofore stated in connection with these two types of hard cylinders, it was found that shortly after being molded

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and turned down, a bluish-white incrustation, resembling mould, appeared upon the surface, and the longer the cylinders stood before being used the greater became this mould or incrustation. This was found very objectionable by users, especially in connection with cylinders on which records were made which were designed to be permanent, for the mould would form in the record grooves and in reproducing the record this conduced to confusion of the sounds and the production of scratching noises. This objection, too, was fully recognized by the Graphophone Company, and particularly by its manager, E. D. Easton. It was one of the causes which in May, 1894, induced the Graphophone Company to discontinue the manufacture of cylinders. Prior to this, however, every effort was made to avoid the difficulty. During the early experiments the Graphophone Company even went so far as to purchase from the United States Phonograph Company a quantity of fragments of phonograph cylinders of metallic soap (known as "scrap wax"), made by the Edison Company, and this was melted down at the Bridgeport factory and remoulded into new cylinders. It was found that the cylinders made from this Edison Company material did not have the objectionable feature of incrustation referred to.

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The manufacture of cylinders like the hard types referred to was commenced some time in the fall of 1893, and continued to some extent up to the time I left the Graphophone Company, in May, 1894.

I do not wish it to be understood that these hard cylinders were manufactured in any large quantities by the Graphophone Company, for this is not the case. In fact, the manufacture of these cylinders initially was experimental, and after such experimental construction they were manufactured only to a limited extent. Many more "P-cylinders" were made than "E-cylinders."

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The changes in the Graphophone cylinders occasioned corresponding changes in the recorders and re-

237 producers employed in that connection. With the old ozokerite cylinders a steel recorder and an ordinary metallic pointed reproducer had been employed. In the spring or summer of 1892, the Graphophone Company put out a few machines having a bar or "slab" recorder of sapphire. Both of these types of recorders were found objectionable, not only because they conduced to what is known as "chattering," but also because they were readily worn down and dulled by the impurities in the recording material. Therefore, after discarding the
238 soft wax cylinders and employing the harder material above referred to, the Graphophone Company placed upon the market machines employing recorders and reproducers which were the exact counterparts of those theretofore employed in the Edison phonograph, that is to say, they provided each of their machines with a recorder having a circular cutting edge and known as the "cup-recorder," and a spherical reproducer known as the "ball-point," both recorder and reproducer being of sapphire or other precious stone. These Edi-
239 son recorders and reproducers used in connection with the hard recording composition first employed by the Edison interests, gave the Graphophone Company the first glimpse of commercial success. Before this time, the graphophone was incapable of practical use. Its usefulness increased in proportion as it drew to it those features of the phonograph which had made the latter a business success.

Now, as to the extent to which graphophones and phonographs have been in use. By reason of my con-
240 nection with both interests, as I have heretofore set forth, I am enabled to testify to these facts from my personal knowledge. Previous to the time that the Graphophone Company employed phonograph blanks upon its graphophones (this being in May, 1893), it had been totally unable to place upon the market a commercially successful machine. Prior to this time but a very limited number of graphophones had been sold. A considerable number of them were put in ex-

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perimental use, but were decidedly unsatisfactory, be- 241
cause they did not meet the requirements. Indeed,
after May, 1893, the graphophones placed upon the
market even with the *phonograph* blanks were still un-
satisfactory, for the reason that the corresponding
changes had not been made in the mechanism to permit
said blanks to be employed, and it was not until the
latter part of the summer of 1893 that the graphophone
was so far modified as to make the use of these phono-
graph blanks practicable. It is true, however, that a
few of the exhibition graphophones which were adapted 242
to be operated by means of a coin acting upon certain
releasing mechanism were changed before the com-
mercial machines; that is to say, shortly after May,
1893. The changes made in the commercial grapho-
phones to adapt them to use the phonograph blanks
consisted, as I have said, in replacing the old recorders
and reproducers with those forms now in use, these
consisting of the recording style of sapphire and cup-
shaped, and the reproducer also of sapphire and
having a ball-point. These forms were, as I have said, 243
adapted from the phonograph.

The commercial success of the graphophone, if it
has had any, dates from the time when these
changes were made. I am, of course, unable to
testify upon my own personal knowledge of the
extent of use of these graphophones, that is to
say, the actual number employed, but, from the daily
contact which I have had with people who make use of
sound recording and reproducing machines, I have no
hesitation in saying that there are to-day a far greater 244
number of phonographs actually in daily use than
there are graphophones. The phonograph is decidedly
the more practicable machine of the two, notwith-
standing the adoption by the graphophone of the im-
portant features taken from the phonograph, and this
is fully recognized by users who have had occasion to
compare both devices. During the period that I rep-
resented the Graphophone Company, both in New

245 York and Washington, although I daily attempted to make sales of graphophones, I was wholly unable to do so, and my failure to make these sales I attribute to the fact that the machine was impracticable, and would not answer the purpose for which it was designed.

EBEN G. DODGE.

Sworn to and subscribed before me this 7th day of December, 1894.

EUGENE CONRAN,

246 [SEAL.] Notary Public,
Kings & N. Y. Counties.

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IN THE UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. CLEVELAND WALCUTT ET AL.	In Equity. No. 250

Affidavit of Cleveland Walcutt.

STATE OF NEW YORK,
City and County of New York, } ss.:

CLEVELAND WALCUTT, being duly sworn, deposes and says: I am 32 years of age, reside in New York City, and am a member of the firm of Walcutt, Miller & Co., 251 dealers in talking machines and supplies therefor. I was associated with Mr. Jesse H. Lippincott prior to the organization of the North American Phonograph Company in July, 1888. At that time I became the head bookkeeper and cashier for that company, and subsequently became the secretary of the company, which latter position I held until the company went into the hands of a receiver, in August last. At that time I organized the firm of Walcutt, Miller & Co., and purchased and continued a certain department of the busi- 252 ness of the North American Phonograph Co., in which business I am now engaged.

From the positions I occupied in the North American Phonograph Co., I am well acquainted with the general history of the business of that company, and particularly with the accounts which appear upon the books of that company. I established for the North American Phonograph Co. a system of keeping an account of the movements of all the machines owned by that

253 company, so as to show at all times where all the machines owned by the company were. That system of acounts I continued throughout my connection with the North American Company, and consequently I am well acquainted with the details of the business of that company in this respect. The course of business was as follows :

With respect to the phonograph, the Edison Phonograph Company manufactured the machines and shipped them on the order of the North American
254 Phonograph Co., directly to the local companies which had been organized and to whom the machines were rented by the North American Phonograph Co. The Edison Phonograph Works continued to manufacture the phonograph and to bill the machines to the North American Phonograph Co. until a certain number of machines were so manufactured and billed. This number was reached January 1, 1890, after which time no further phonographs were billed to the North American Company, except a few machines of a different
255 pattern from the regular machines, none of which, according to my recollection, were ever sold by the North American Company. The phonographs which had not been sent to local companies up to January 1, 1890, were held in stock by the Edison Phonograph Works subject to the orders of the North American Phonograph Co., and they were shipped out to local companies on rental from time to time as the North American Phonograph Co. so directed. The last of these shipments was made prior to February 1, 1891.

256 With regard to the graphophone, machines were ordered from the Graphophone Company through Mr. Lippincott, and were shipped to local companies as ordered.

The phonographs which are now in the hands of users in this country are the machines which were manufactured and billed to the North American Phonograph Co. prior to January 1, 1890, and which were all shipped to the local companies on rental prior to February 1, 1891. Mr. Lippincott was under

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contract with the American Graphophone Company to 257
pay that company a certain amount of money upon each phonograph which he sent out to the local companies. The course of business was for the American Graphophone Co. to periodically render accounts against Mr. Lippincott, including items for these royalties, upon the phonograph, and an account was kept on the books of the North American Phonograph Co., with the American Graphophone Co., showing the items and totals of the bills so rendered, and payments were made upon this account to the American Graphophone 258
Co. by the North American Phonograph Co., through Mr. Lippincott, sometimes by the check of the North American Company made to the American Graphophone Company's order, and sometimes by Mr. Lippincott's check made to the order of the latter company. By an examination of this account on the books of the North American Phonograph Co., I find that the American Graphophone Co. was so paid $285,674.90, of which amount $42,795.53 was represented by notes of Mr. Lippincott, and the balance was paid in cash. On 259
May 13, 1891, the American Graphophone Co. returned to Mr. Lippincott $31,069.75 of the notes, by a letter stating that they had taken back in payment of the notes a certain number of graphophones. These machines had been billed, but had never been actually delivered.

On April 30, 1891, or within a few days of that date, the American Graphophone Co. rendered a bill against Mr. Lippincott, including an item of $2,100 for phonograph royalties, and an item of $472.55 for royalties on 260
phonograph supplies. This account was rendered in response to a letter from Mr. Lippincott asking the American Graphophone Co. to render their account against him up to April 30, 1891, and the account was entered upon the books of the North American Phonograph Co., as a statement of the American Graphophone Company's account in full to April 30, 1891. Since, to my knowledge, all the phonographs had been sent out to the local com-

261 panies on rental by the North American Phonograph Co. prior to April 30, 1891, it thus appears from the books of the North American Phonograph Co., and is in accordance with my recollection, that the American Graphophone Co., at a later date than the shipment of any machines, recognized the authority of the North American Phonograph Co. to ship such machines, and asserted its claim against Mr. Lippincott for royalties on the machines so shipped. It is true that many of these phonographs were, in the course of the business
262 of leasing and releasing machines, returned to the North American Phonograph Co. Most of these returned machines were re-leased several times and finally sold either by the North American Company or by the Receiver of that company, and many were so released and sold after April 30, 1891, but all of these machines were either included in the accounts rendered by the American Graphophone Co. on and prior to April 30, 1891, or should have been so included under the arrangements between that company and Mr. Lip-
263 pincott. Only one royalty was payable upon each machine, and that was payable when the machine was originally sent out.

All phonographs which were leased or sold were provided with devices both for recording speech, musical or other sounds, and for reproducing the same, and were also provided with blank cylinders upon which such records were to be made. The machines were designed for this purpose, and were leased or sold with the intention that they could be so used, both for re-
264 cording and reproducing. This was true of all the phonographs put out, with the exception of the automatic or slot machines, which were designed to be put in public places and operated by any person by putting a coin in the slot. These machines, of course, were only provided with reproducing devices, but were the same as the other machines in other respects, the recording devices and the knives for turning off the cylinder not being shipped with the machines.

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organized by Mr. Lippincott for the purpose of exploit- 265
ing the business of leasing and selling both phonographs and graphophones under the patents on both of those machines, his rights under both sets of patents being assigned to that company. Local or sub-companies were organized in various parts of the country, upwards of thirty in number, and to these companies were given exclusive licenses under both sets of patents (including the patents in suit) for limited territories. These licenses were all extended up to March 26, 1903. I have read the contract of the 266
New Jersey Phonograph Company attached to the affidavit of George E. Tewksbury, given for the defendants in this case. That contract is an example of the contracts made by the North American Phonograph Company with local or sub-companies. All such contracts were substantially alike in their terms. The New York Phonograph Company, hereinafter referred to, received and operated under a contract of this same character. At first the machines were shipped to the local companies, and were to be had on lease, but 267
subsequently the local companies were authorized to sell the machines. These business arrangements made by Mr. Lippincott through the North American Phonograph Company were well known to the officers of the American Graphophone Company, and the American Graphophone Company received a share of the profits arising from the business so organized and conducted.

In my relations to the phonograph and graphophone business as employee and officer of the North American 268
Phonograph Company, I became acquainted with the relative merits of the phonograph and graphophone as they were put upon the market by the North American Phonograph Company. The contracts with the sub-companies required each of such companies to offer both the phonograph and the graphophone to the public "with absolute impartiality, leaving the person or persons with whom it is dealing to make his or their own selection," and further provided that the sub-

269 company, " its officers, agents and employees, shall in no way press the introduction of one instrument at the expense of the other." At first a great many machines of both types were shipped out, but the graphophones soon began to be returned, until practically all the graphophones which the company had shipped out were again upon its hands. These machines proved to be entirely uncommercial, and the company, finding it impossible to get users to take them, the machines were finally shipped to the Edison Phonograph Works,
270 where they now are, so far as I know. These graphophones which were so put out by the North American Phonograph Company and were returned to it as uncommercial, numbered some 3,000 machines, for which the North American Phonograph Company paid the American Graphophone Company, through Mr. Lippincott, upwards of $200,000. Since the phonograph was the only machine which the public could be induced to use, it became necessary for the North American Phonograph Company to continue its business ex-
271 clusively with the phonograph, and no graphophones were shipped or put into use by the North American Phonograph Company after an early date in the history of its business.

The firm of Walcutt, Miller & Co., of which the defendants are members, was organized in the latter part of August, 1894, for the purpose principally of taking over and continuing the business of making musical and other phonograph records for exhibition purposes, which had been theretofore carried on by the North
272 American Phonograph Company and subsequently by the Receiver of that company. For several years, the North American Phonograph Company had conducted a separate department devoted to the making of musical and other exhibition records, and had established a considerable plant for that purpose at No. 120 East Fourteenth street, New York City. My partner, Mr. Miller, was in charge of that plant. The phonographs which were a part of that plant and were used in the making, testing and exhibiting of the records, were ma-

agents and employees, shall in
luction of one instrument at the
A first a great many machines
ped out, but the graphophones
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the company had shipped out
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ial, and the company, finding it
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the Edison Phonograph Works,
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chines which had been used for several years by the 273
North American Phonograph Company, and were a part of the machines which, as I have already stated, were shipped out to local companies on rental prior to February 1, 1891, and had been returned to the North American Phonograph Company in the process of leasing, re-leasing and selling machines.

The North American Phonograph Company went into the hands of a Receiver August 21, 1894. A short time after that date, the firm of Walcutt, Miller & Co. entered into negotiations with the Receiver to purchase 274
the plant at No. 120 East Fourteenth street, and the supplies and records then on hand, with a view of continuing that department of the business, and on September 5, 1894, the sale of such plant to Walcutt, Miller & Co. was consummated by a bill of sale from the Receiver, given under the order of the Court, and since said last named date the business has been continued by our firm. All the members of our firm were formerly connected with the North American Phonograph Company, and we have continued this branch of the 275
business of said North American Company, dealing with the former customers of that company.

The machines we use in our business are the identical machines which we thus purchased, and which had been used for the same purpose by the North American Phonograph Company and the Receiver for several years, and no others, and are and were machines upon which royalties were either actually paid to the American Graphophone Company by the North American Phonograph Company, or upon which such royalties 276
were payable, prior to February 1, 1891. At the time of making this purchase, there were included in the purchase a stock of blank phonograph cylinders, which we have used in making records, and since that date such cylinders as we have purchased have been purchased by us from the Receiver of the North American Phonograph Company. We have also sold a number of phonographs and some blank phonograph cylinders, as well as phonograph records, but all the phonographs

277 we have ever bought or sold were purchased by us from the Receiver of the North American Phonograph Company, and were machines of the class already referred to by me, namely, such as were originally sent out by the North American Phonograph Company prior to February 1, 1891, and upon which royalties were paid or payable prior to that date.

In our dealings with the Receiver of the North American Phonograph Company, said Receiver has not only acted on behalf of that company, but has also
278 acted on behalf of, and as agent for, the New York Phonograph Company, a company which is licensed under both the graphophone and phonograph patents and for the entire State of New York, including the City of New York. A copy of the contract creating the North American Phonograph Company the agent of the New York Phonograph Company is attached hereto and marked "Exhibit A," the same being dated July 1, 1893. That contract was operated under by the North American Phonograph Company, and subsequently by
279 the Receiver. I understand that the New York Phonograph Company attempted to cancel said contract in October or November, 1894, and subsequent to the sale of the plant by the Receiver to Walcutt, Miller & Co., but that the Receiver has never assented to or recognized such cancellation and has continued since said date to do business under said contract by selling phonographs and supplies in the State and City of New York.

All the phonographs, parts of phonographs, blanks
280 and records which have ever been purchased, used or sold by the defendants have been so purchased, used or sold with full authority from the Receiver of the North American Phonograph Company, acting not only under the rights of said company, but also under the rights secured by the contract of July 1, 1893, from the New York Phonograph Company.

The American Graphophone Company does not make musical and other exhibition records, which is the principal part of the business of our firm. Nor does

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ompany.

phophone Company does not make
exhibition records, which is the
business of our firm. Nor does

that company make and sell record blanks which are 281
suitable for that purpose, so far as I know. That company has never offered to sell us any record blanks; on the contrary, the Columbia Phonograph Company, which is understood to be practically the same interest as the American Graphophone Company, the two companies being managed by the same persons, has recently purchased from us three thousand blank record cylinders. This purchase was made by Mr. Easton, who is the active manager of both the American Graphophone Company and the Columbia Phonograph Company, and 282
Mr. Easton well understood that the blanks which he was purchasing were Edison phonograph blanks, purchased by us from the Receiver of the North American Phonograph Company.

I have read the affidavit of Mr. Easton, verified the 14th day of November, 1894, and was present at 120 East Fourteenth street on the day he called there. Said Easton was in my presence during the entire time that he remained at our place of business. Although sound records are made 283
by the firm of Walcutt, Miller & Co., by processes known only to the members of that firm, the statement of said Easton in the said affidavit that he "observed the operations there carried on of making musical and other sound records," is untrue. No records were being made in the apartment where said Easton was, and if any were being made at the time they were being so made elsewhere and could not have been seen by said Easton. We do not admit persons to our operating rooms, other than those who are there employed, 284
and Mr. Easton, neither on the day referred to in his affidavit nor at any other time, has entered such rooms.

The firm of Walcutt, Miller & Co. is composed of financially responsible persons. The plant and stock which we purchased from the Receiver of the North American Phonograph Company, and which we now have on hand, has a value of several thousand dollars, and we enjoy good credit in the trade. We occupy the

285 premises formerly occupied by the North American Phonograph Company at No. 120 East Fourteenth street, and pay an annual rental of $2,000. The permanent machinery used by us is securely attached to the building, and includes a steam engine and adjuncts, a dynamo, shafting, lathe and permanent benches, and we are fully able and stand ready to respond to any judgment which may be rendered against us in this case.

CLEVELAND WALCUTT.

286 Subscribed and sworn to before me this 10th day of December, 1894.

EUGENE CONRAN,
Notary Public,
Kings and N. Y. Counties.

[SEAL.]

287

288

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ompany at No. 120 East Fourteenth
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sworn to be-
10th day of
94.

EUGENE CONRAN,
Notary Public,
Kings and N. Y. Counties.

289

Walcutt's Exhibit A.

This agreement, made this First day of July, 1893, by and between The North American Phonograph Company, a corporation organized under the Laws of the State of New Jersey, party of the first part, and the New York Phonograph Company, a corporation organized under the Laws of the State of New York, party of the second part,

290 WITNESSETH:

That for and in consideration of the sum of One Dollar by each to the other in hand paid, and of other good and valuable consideration, the receipt of which is hereby acknowledged, it is agreed by the parties hereto as follows:

FIRST. From the date of this Agreement to and until the 1st day of July, 1895, the performance by the parties hereto of the covenants, stipulations and duties made incumbent upon them respectively by the terms of a certain Agreement bearing date the Sixth day of 291 February, 1889, made and executed by the party of the first part hereto, as the party of the first part therein, and by John P. Haines as the party of the second part therein, and a like performance of the covenants and stipulations of any subsequent agreements made by the parties thereto or either of them according to the terms of said Agreement of February 6th, 1889, is hereby waived so far as the same or any of them would in any way conflict with the performance of the Agreements made by this instrument. 292

And from the date of this Agreement to and until the first day of July, 1895, the performance by the parties hereto of the covenants, stipulations and duties made encumbent upon them respectively by the terms of a certain Agreement bearing date the twelfth day of October, 1888, made and executed by the party of the first part hereto as the party of the first part therein, and by the Metropolitan Phonograph Company as the party of the second part therein, as

293 the same stands amended by Agreement between the same parties, dated January 10th, 1889, and a like performance of the covenants and stipulations of any subsequent Agreements made by the parties thereto or either of them according to the terms of said Agreement of October 12th, 1888, as amended as aforesaid, is hereby waived so far as the same or any of them would in any way conflict with the performance of the agreements made by this instrument.

It being understood that on or about the day of
294 , 1890, said The Metropolitan Phonograph Company and the party of the second part hereto said New York Phonograph Company were consolidated into a single corporation with the consent of the party of the first part hereto, and that the party of the second part hereto has since covered and operated, and is now covering and operating, the territory originally covered and possessed by the two Companies so consolidated, when taken together, viz., the whole of the State of New York.

295 SECOND: From the date of this Agreement until the first day of July, 1895, the party of the first part, The North American Phonograph Company, shall have the sole and exclusive right to exploit, lease, sell, and otherwise dispose of the instrument known as the Phonograph, and all supplies, appliances and attachments therefor, in and throughout the territory now covered and operated by the party of the second part, and it being expressly understood and agreed that the party of the first part may
296 sell, lease or dispose of such Phonographs without in any way restricting the use of the same, or, in other words, shall, in the language of the trade, have the right to make "unrestricted sales" of Phonographs, supplies, appliances and attachments therefor, and it being further expressly understood and agreed that the business so transacted by the party of the first part shall be at its own cost and expense, and without risk or contribution in any way of or from the party of the second part.

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nts made by the parties thereto or
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nces and attachments therefor, and it
xpressly understood and agreed that the
nsacted by the party of the first part
own cost and expense, and without risk
in any way of or from the party of the

THIRD. The party of the first part shall pay to the 297
party of the second part a sum of money equal to ten per centum of the selling price to the public of all Phonographs, supplies, appliances and attachments therefor, sold in, or sold to be used in, the territory now covered and operated by the party of the second part, and a sum equal to twenty-five per centum of all the rents paid by lessees for Phonographs, appliances and attachments, leased or rented in, or leased or rented to be used in, said territory, and a sum equal to ten per centum of gross amount received by the party of the 298
first part from exhibitions and automatic machines and from any other income derived from the business done in the State of New York that the party of the second part, said New York Phonograph Company, would have the right to do if operating under the original Agreements.

FOURTH. Within fifteen days after the expiration of each first day of January, April, July and October, in each year during the continuance of this Agreement, the party of the first part shall, and hereby agrees to, 299
pay to the party of the second part any sum or sums of money that may have become due under this Agreement upon the business of the quarter ending with said first day of January, April, July or October; and it is further understood and agreed that reports shall be made by the party of the first part to the party of the second part, on or before the 15th day of each month, showing all sales and leases or rentals of either instruments or supplies during the previous month.

FIFTH. The stock of supplies and appliances apper- 300
taining to the Phonograph, and now on hand in the possession of and belonging to the party of the second part, shall be taken and purchased by the party of the first part at prices and upon terms to be mutually agreed upon. In the event of the failure of the parties hereto to agree upon such prices within sixty days after the execution and delivery of this Agreement, then such prices shall be settled by three appraisers—one to be appointed by the party of the first part, one

by the party of the second part, and the third by the two so appointed; and a decision by two of the three so chosen shall be binding upon the parties hereto. If at the time when any amount shall be so found to be due to the party of the second part by the party of the first part, the party of the second part shall be justly indebted to the party of the first part in any sum of money, then the amount so found to be due, or so much thereof as may be required to liquidate said indebtedness shall be credited to the party of the second part by the party of the first part. And such credit shall thereupon be considered as a payment under this Agreement *pro tanto*, and thereafter, if the party of the second part shall remain justly indebted to the party of the first part, the balance so remaining due shall be liquidated by the party of the first part from the earliest accruing amounts that shall fall due to the party of the second part under the provisions of paragraphs "Third" and "Fourth" of this Agreement.

Any excess of stock of supplies and appliances over and above the indebtedness of the party of the second part to the party of the first part as aforesaid, if any there shall be, shall be taken and held by the party of the first part on consignment and payment shall be made therefor by the party of the first part to the party of the second part, as and when the same shall be sold by the party of the first part.

SIXTH. The party of the first part shall each year, during the continuance of this Agreement, expend in advertising its business in and throughout the United States of America at least the sum of five thousand dollars, including, amongst others, suitable advertisements in the following magazines and publications, viz.: "The Century," "Harper's Monthly," "Scribner's," "The North American Review," "Youth's Companion" and "St. Nicholas." It is understood that this provision for advertising is contained in, and will hereafter be inserted in the various Agreements of other companies or individuals, and that it is intended to pro-

vide for the expenditure of one sum of five thousand 305
dollars only, and not as a separate covenant in the case of each agreement.

SEVENTH. The party of the first part agrees to use its best endeavors to successfully exploit the business of selling Phonographs, supplies, attachments and appliances therefor, in and throughout the territory covered by this Agreement, and in and throughout the United States of America, and for that purpose shall select and employ the most competent, suitable agents, to whom it will pay commissions averaging about thirty- 306
three and one-third per centum on the ultimate selling price of Phonographs.

EIGHTH. It is expressly understood and agreed between the parties hereto that this Agreement shall not in any way impair the rights of the parties hereto as fixed by Agreements heretofore made between them, except as herein provided, but that, subject to the provisions of this Agreement, the party of the first part, so far as it has the legal right or authority so to do, hereby fully ratifies and confirms said Agreement here- 307
tofore made, and the licenses, privileges, rights, easements, guarantees, terms and conditions heretofore granted by the party of the first part to the party of the second part.

NINTH. It is expressly understood and agreed that the party of the first part has fully and fairly represented to the party of the second part the exact condition of its present business relations with the American Graphophone Company, and the instrument heretofore known or designated as 308
the Graphophone br Phonograph Graphophone, and that this Agreement is made subject to any complications that may hereafter arise in respect thereto.

TENTH. It is further understood and agreed that this Agreement shall in no way operate as a release by the party of the first part of any of its rights with respect to the stock of the party of the second part, which is provided to be hereafter delivered to the party of the first part, or to Jesse H. Lippincott, Trustee, or his suc-

309 cessor, as the party of the first part may direct, or to the benefits arising from said stock from the time of its delivery.

In witness whereof the parties hereto have respectively caused this instrument to be executed by their proper officers and their respective corporate seals to be hereto affixed the day and year first above written.

THE NORTH AMERICAN PHONOGRAPH CO.,
By THOMAS A. EDISON,
Presdt.

310 NEW YORK PHONOGRAPH CO.,
WM. FAHNESTOCK,
[SEAL.] Vice-President.
Attest.
RICHARD TOWNLEY HAINES,
Secretary.

311

312

of the first part may direct, or to
from said stock from the time of

eof the parties hereto have respect-
instrument to be executed by their
their respective corporate seals to
e day and year first above written.
NORTH AMERICAN PHONOGRAPH CO.,
By THOMAS A. EDISON,
Presdt.
NEW YORK PHONOGRAPH CO.,
WM. FAHNESTOCK,
Vice-President.

OWNLEY HAINES,
Secretary.

313

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
CLEVELAND WALCUTT ET AL.
} In Equity.

314

Affidavit of Herman Kusterer.

STATE OF NEW YORK,
City and County of New York, } ss.:

HERMAN KUSTERER, being duly sworn, deposes and says as follows:

315

I am twenty-eight years of age, reside at Bayonne, N. J., and am by occupation a technical translator, a business in which I have been engaged for several years last past.

I have examined the issue of December 11, 1877, of "Le Rappel," a journal published at Paris, France, and have translated into English an article published in that issue over the signature of Victor Meunier, entitled "Sound Put into Bottles by Mr. Charles Cros." This article purports to describe in part Mr. Charles Cros' phonograph. The pertinent portion of the description is contained in the following paragraph:

316

L'enregistrement de la voix se fera sur un cylindre tournant et progressant, cylindre enduit d'une substance plastique telle que la paraffine; les traces s'y marqueront en creux par un index commandé par un levier à bras inégaux qui en amplifiera les écarts. Ensuite ces traces seront traduites en moulage métallique par la galvanoplastie. "Je prévois la possibilité, nous

317 écrit l'auteur, de couvrir le cylindre d'un enduit gras qui permettrait de creuser les traces à l'acide."

The foregoing paragraph I translate as follows:

The registering of the voice will be effected on a turning and progressing cylinder, which cylinder is coated with a plastic substance such as paraffine; the lines will be gouged out on the same by an index actuated by a lever with unequal arms which will amplify its movements. Then these lines will be changed into a metallic plate
318 by the galvanoplastic process. "I foresee the possibility, writes the author to us, of covering the cylinder with a fatty coating, which would permit of cutting out the lines by an acid."

I attach hereto a translation made by me of an article published in "Les Mondes," for September-December, 1878. "Les Mondes" is a journal published at Paris, France. The article referred to is a communication from the Abbé Carbonel relating to the phonograph.

I also attach hereto copies of articles describing
319 Lambrigot's phonograph, such articles being taken (1) from Du Moncel's book on "The Telephone, the Microphone and the Phonograph," New York, 1879; (2) from the "Journal of the Society of Telegraph Engineers," London, 1879, and (3) from "Engineering," for 1879, a journal published in London, England.

HERMAN KUSTERER.

Subscribed and sworn to before me this 8th day of December, 1894.

320 EUGENE CONRAN,
[SEAL.] Notary Public,
Kings and New York Cos.

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les traces à l'acide."
I translate as follows:
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79, and (3) from "Engineering,"
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HERMAN KUSTERER.

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EUGENE CONRAN,
Notary Public,
ngs and New York Cos.

321

Kosmos.

LES MONDES.

WEEKLY REVEIW OF SCIENCES AND OF THEIR APPLICATIONS TO THE ARTS AND INDUSTRY.

BY

THE ABBÉ MOIGNO.

322 Sixteenth year. September-December, 1878. Volume forty-seven. Pages 590 and 591.

Physical news. Phonograph. Communication from the Abbé Carbonel, professor at the Belsunce school, Marseille.

In every phonograph there must be a receiver and a producer. The receiver should be an ear, a membrane as delicate as that of the ear, if it can be manufactured, with a very sensitive stretched sheet. The reproducer, 323 on the contrary, needs a very hard stretched sheet and a very sonorous vibrating plate. To obtain this sheet, sensitive first and then hard, it would suffice to use a band of copper coated with a thin layer of wax; by then acting on it with *aqua fortis* a very resistant plate would be obtained, which would permit of communicating very intense and very distinct vibrations to a vibrating plate chosen and arranged according to the best experiments.

At any rate, an objection is to be avoided in this pro- 324 ceeding, that is, the minimum intensity of the sounds. To remedy this, the following is my method:

I use thick albumen on paper or another material, instead of the thin wax applied on copper. I then harden it by the known process, and I thus obtain a plate the hollows of which have a greater or lesser depth according to the greater or less intensity of the sounds. There only remains to find by experimenting the best vibrating plate to reproduce

325 the sounds; the best, in view of the substance, the size and the form.

Perhaps the process employed in the Savart wheel would be better than a plate; nothing would prevent the reinforcing or modifying of its sound by means of a sounding box to which the card or vibrating plate would be fixed.

THE TELEPHONE, THE MICROPHONE AND THE PHONOGRAPH,

326 BY

COUNT DU MONCEL.

Published at New York, 1879, by HARPER & BROS.

M. Lambrigot, one of the officials on the telegraphic lines in France, and the author of various improvements in the Caselli telegraph, has shown me a phonographic system of his own invention, in which it is reduced to its simplest form. He sent me the following
327 description of his system:

"The instrument consists of a wooden slab placed vertically on a stand and firmly fixed upon it. There is a round opening in the middle of the slab, covered by a tightly stretched sheet of parchment, bearing a steel knife, which, like the tracing point of the phonograph, is intended to trace the vibrations. A solid block rises from the stand to the middle of the slab and supports a slide on which a runner can move in front of the slab. There is a strip of glass on this runner, of which one
328 side is covered with stearine. When the runner is moved to and fro the stearine comes in contact with the knife, and takes the mold of its form, which is curved throughout.

"A metal plate [illegible] the sheet of parchment in vibration, and imparts its movement to the knife, which traces various lines on the surface of the stearine.

"'The reproduction thus obtained on the strip of glass is subjected to the ordinary process of metalization. By galvanism a deposit of copper is obtained,

n view of the substance, the size

employed in the Savart wheel
plate; nothing would prevent
ifying of its sound by means of
ich the card or vibrating plate

ICROPHONE AND THE PHONOGRAPH,

BY

r Dr MONCEL.

ık, 1879, by HARPER & BROS.

f the officials on the telegraphic
he author of various improve-
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own invention, in which it is re-
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t of parchment, bearing a steel
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vibrations. A solid block rises
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er can move in front of the slab.
on this runner, of which one
tearine. When the runner is
tearine comes in contact with
he mold of its form, which is

of parchment in vibr
to the
which
he surface of the stearine.
thus obtained on the strip of
ordinary process of metaliza-
posit of copper is obtained,

which reproduces the lines in an inverse way. In 329
order to make the metallic plate speak it is necessary to pass a point of ivory, wood or horn lightly over the signs, and by moving it more or less quickly the different tones can be heard just as they were spoken.

"'Since copper is relatively harder than lead, the copper plate on which the vibrations are traced will afford an unlimited number of reproductions. To obtain this result a lead wire must be applied to the plate and due pressure must be exerted on it. The wire is flattened and takes the impression of all the 330
traces which then appear in relief. If the edge of a card is passed through this impressed tracing the same sounds are produced as those which are obtained from the copper plate'" (pp. 259 and 260).

JOURNAL OF THE SOCIETY OF TELEGRAPH ENGINEERS. LONDON, 1879, VOL. VIII.

Exhibiton of Lambrigot phonograph by Mr. Hospitalier. 331

DR. C. M. SIEMENS—"We have here this evening a visitor from France—Mr. Hospitalier—who has introduced to my notice, and, I believe, to several other members of the society, a very interesting modification of the phonograph. It is a very simple apparatus and I have requested Mr. Hospitalier to be good enough to bring the instrument here this evening in order to give the members present an opportunity of seeing it. I may describe it in a few words. It consists, in the first place, of a lead wire upon which certain impressions 332
are engraved. These engravings are produced in the following manner: The phonograph, armed with a knife edge instead of a point passing over a sheet of tin-foil, passes over a bar of stearine. This bar of stearine receives the phonographic impression. Upon this bar being covered afterwards with a conducting substance, such as plumbago, a deposit of copper is made by an electrotyping process, and into this mould lead wire is pressed either by being beaten down upon it or being

333 pressed in any covenient manner upon it, and thus stereotype impressions are produced for the phonographic moulding. On passing this little disk of paper over these indentations the word to be repeated is distinctly heard on placing to the ear this little funnel of cardboard wihch is connected to paper disk by leaden wire.

NOTE.—The instrument was then exhibited, but it did not work well, because there was a flaw in the lead "phonogram."

334

ENGINEERING.

1879.

VOL. XXVII.

JANUARY TO JUNE. PAGE 326.

A SIXPENNY PHONOGRAPH.

335 When a great scientific discovery or invention is announced to the world, such, for example, as the telephone of Professor Graham Bell, the microphone of Professor Hughes, of the phonograph of Mr. Edison, it is pretty certain in a short time to be followed first by spurious and unauthorized imitations, which, if the invention be protected, are nothing more or less than direct infringements of the patent, and after that by highly interesting modifications of the apparatus either for the extension of the principle, developing further
336 physical facts, or to analyze those already discovered; or else for the reduction of the instrument to its simplest possible form, so as to place in the hands of the teacher as well as in those of the million a scientific toy which can illustrate and render familiar the principle which lies at the base of the more important and typical apparatus.

There are few who can have failed to see that both the telephone and the microphone have gone through both these stages, and the phonograph, after having

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been imitated by amateurs and copied by un- 337
licensed manufacturers, has led to the very beautiful analytical and synthetical apparatus of Mr. Stroh, and has quite recently reappeared as a curious and most interesting scientific toy, and one which we would hesitate to say could not be made applicable to some useful purposes.

The very simple apparatus which we illustrate below is a speaking phonograph that can be made and sold for sixpence, or even less, and yet leave a profit to the manufacturer. It is the invention of M. Lambrigot, 333
an inspector of telegraphs at Albi, in the Department of Tarn, in the south of France, and has been brought to this country by M. Hospitalier, whose name is well known in connection with physical and electrical science.

The whole apparatus, which is represented in Fig. 1, consists, first, of a hollow cone of pasteboard, about 1½ in. in diameter, whose apex is connected to the centre of a similar sized pasteboard disc by means of a lead wire about 16 in. long; and, second, of a small 339
board or tablet, on which is fixed one, or a larger number of short lengths of lead wire, each of which bears upon its upper surface a phonographic embossed record corresponding to a certain word or sentence, by which it was originally produced by a process to be described further on.

To those who are familiar with the construction of the phonograph in the form in which it was first shown in this country, and which was fully described in these columns more than a year ago,* it would 340
appear necessary, in order to reproduce the sounds recorded on the tablet for the edge of the disc to be held in an annular frame, so as to convert it into a diaphragm, and for its centre to be thrown into vibration by means of a point or style projecting from it and drawn over the undulatory surface of the record. But the method of using the apparatus is far simpler than that; all that is necessary is to hold the paper cone against the ear

with one hand, and with the other to take hold of the cardboard disc, drawing its edge along the record with a steady scraping motion, and the mechanical vibrations thus set up in the disc being communicated by the wire to the conical ear-piece which serves as a resonater and concentrator, produce in the organs of hearing the sensation of the articulate sound by which the markings on the leaden record were originally produced. We should have thought that a stout thread or a lighter wire would have formed a more efficient as well as a cheaper connexion for the purpose than the lead wire, but we are informed that M. Lambrigot has found the lead to answer the purpose better than anything else; it does not require to be kept stretched between the cone and the disc, and being of a very inelastic nature it does not spring about and produce disturbing sounds by clashing against itself or against neighboring objects. Again, it would naturally be expected that the ear-piece would be more perfectly adapted to its purpose if it were in the form of that used in the ordinary thread telephone—that is to say, if it consisted of a cylindrical cardboard box closed at one end with a stretched paper diaphragm, to the centre of which the connecting wire were attached, but simple as it is, this would undoubtedly be a more complex form of construction than the cardboard cones, and would be far more liable to be destroyed by the weight of the connecting wire. The employment of cardboard as the material of which the principal parts of the apparatus are constructed is, in the case of the cone, for cheapness, and in that of the disc partly for cheapness, but chiefly to protect the markings on the lead record from being destroyed, as they soon would be if a harder material than card were employed.

The most interesting point connected with this very simple apparatus is the method by which the leaden records are produced, which is as follows: The upper surface of a rectangular prism of glass, or other hard and rigid material, is thickly coated with stearine wax, which is then scraped into a convex

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form, as shown in the diagram Fig. 2, in which *a* rep- 345
resents the glass bar and *b* the convex coating of stear-
ine. This bar is then fixed into a simple phono-
graphic instrument, which by means of a screw or
other mechanical contrivance traverses it at a suitable
speed below a diaphragm. This diaphragm is rigidly
held around its circumference by an annular frame-
work (not shown in the diagram), and is in every re-
spect exactly similar to the diaphragm of an ordinary
phonograph. To the centre of this diaphragm is at-
tached a thin, flat plate, whose lower end is cut out to a 346
concave curve to fit the convex surface of the stearine
b. When all is properly adjusted, and the temperature
is so arranged as to give the stearine surface the proper
degree of hardness to insure the best results, the handle
of the instrument is turned, and at the same time
words are spoken against the diaphragm, which imme-
diately set up in it vibrations, which are communicated
to the plate or style. While this is moving up and
down, following the vibrations of the diaphragm
caused by the voice, the stearine coating of the bar *a b* 347
is steadily drawn in the direction of the arrow below
the vibrating bar, receiving from it a phonogram simi-
lar to that produced on the tin foil of an ordinary pho-
nograph.

The stearine bar is then coated with a fine surface of
plumbago so as to give to it an electrically conducting
surface, and it is then electro-plated with copper by the
ordinary process; out of the copper coating so formed
the stearine is removed, and a rigid backing of lead
or other metal having been run over the outside 348
convex surface of the copper a firm copper-
lined matrix or mould is formed, the w[illegible]e pre-
senting the appearance shown in Fig. 3, and con-
sisting of a rectangular block having along the
centre of one of its sides a semi-cylindrical groove *c* of
copper, which bears upon its surface certain raised
striations corresponding to the depressions which were
made by the diaphragm on the surface of the stearine.
Into this groove is laid a piece of lead wire of about

three or four millimetres in diameter, and the two being put into a press and squeezed together the surface of the lead wire receives a permanent impression which is an exact reproduction of the original impression made upon the stearine bar. From the copper matrix a very large number of lead impressions may be made, and we are told that the whole process can be gone through, and lead wires, each containing the record of a short sentence, can be made and sold with a profit for one halfpenny each.

It is an interesting fact that if a small stick of wood, such as the stem of a common match, be substituted for the disk shown in Fig. 1, and its end be drawn along the copper groove of one of the matrix moulds shown in Fig. 3, articulate speech is communicated equally well to the ear-piece, although the motion of the point is the reverse of that of the disk; and this bears a very close analogy to the fact that in the ordinary Bell telephone a message is transmitted with equl distinctness whether the poles of the receiving instrument be reversed or not.

We have had an opportunity of testing this simple little instrument, and the words come out of it with remarkable distinctness, though of course with but feeble power; and among the following words, all of which we have heard it utter, some were unmistakably clear: "Mon cher ami," "Louis Quartioze," "Victor Hugo," "Le République," "Octavie," "Bonjour," "Lambrigot," "Miserable" and "Miracle," and it is a curious fact that while in the phonograph the words "Phonograph" and "How do you do?" come out with exceptional distinctness, so in this instrument the words "Bonjour," and the name of the inventor, "Lambrigot," are the clearest of those we have heard.

It is only fair to Mr. Edison, the inventor of the phonograph itself, to point out that the plan of producing a phonogram on a stearine surface, and afterwards reproducing it in copper by the process of electrolysis, was suggested by him long ago, but we do not understand that M. Lambrigot claims any novelty for

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that portion of the invention, but more especially for 353
having produced a little instrument at the cost of a few
pence, which can demonstrate the action of the phono-
graph and illustrate some of the most beautiful phe-
nomena connected with the science of acoustics. We
must congratulate M. Lambrigot on his success and
upon the very beautiful methods by which he has
brought it about, and we hope before long his very in-
teresting little instruments may find their way in large
numbers to this county, for it is by the cheapest and
simplest apparatus that some of the greatest dis- 354
coveries of science are made, not on account of any
intrinsic merit in cheapness, but because popular in-
struments, accessible to thousands, often give to indi-
viduals a first taste for scientific investigation, starting
them on a research which may lead to great things,
and out of the multitude of workers which such inven-
tions instigate, some discoveries are well nigh certain
to be made.

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*See Engineering, vol. XXV., page 186.

Engineering.

Vol. XXVII. 1879. *Page 327.*

Fig. 1.

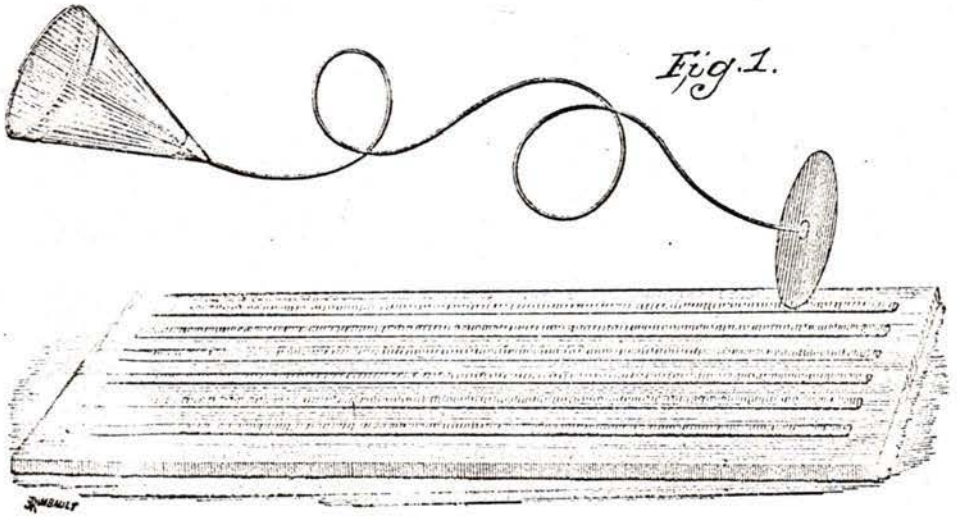
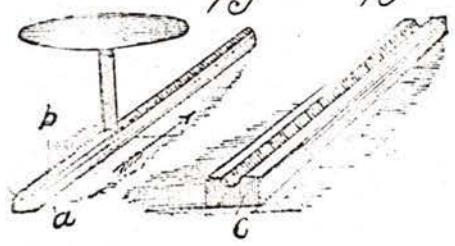


Fig. 2. *Fig. 3.*



357

IN THE UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
CLEVELAND WALCUTT ET AL.
} In Equity.

358

Affidavit of Augustus N. Sampson.

COMMONWEALTH OF MASSACHUSETTS, County of Suffolk, } ss.:

AUGUSTUS N. SAMPSON, being duly sworn, deposes and says as follows:

I am 55 years of age, reside at Boston, Mass., and 359
am a director of the New England Phonograph Company.

I attended the Second Annual Convention of Local Phonograph Companies of the United States, held at New York City, June 16, 17 and 18, 1891. Col. Payne, the president of the American Graphophone Company, addressed the Convention at the evening session held on June 16, 1891. I was present at said session and heard Col. Payne's remarks. The printed report of the proceedings of the Convention for the session referred 360
to, contains the following matter:

"MR. ANDEM: Mr. President, I suggest, as Colonel Payne, President of the American Graphophone Company, is present, that he be requested to address the Convention in regard to the general subject in which we are all interested, and to furnish us such information as he feels prepared at this time to impart.

361 "REMARKS OF PRESIDENT OF AMERICAN GRAPHOPHONE COMPANY.

"COL. PAYNE: The American Graphophone Company received a circular invitation to send a representative to this Convention, and appreciating the magnitude of the enterprise itself, generally, and the effect of good feeling in all branches of it, it requested me to attend as its representative. For what purpose it was desired by you to have our company represented we could not tell. We
362 presumed, however, it was with a view of having our representative present to listen to your discussions and to answer any questions that might properly be answered. As it is proposed that your Committee shall have a conference with me, I do not consider that it would be proper at this time to make any statement as to the policy of that company. I do not think, indeed, that any one could make any statement as to the policy of that company which would be of a definite character.

363 "It may not be out of place for me to remind gentlemen in this connection that, in 1887, the American Graphophone Company was organized and commenced exploiting the Graphophone in the United States and Canada, and this under a license from the Volta Graphophone Company, holding patents for the United States and Canada. In 1888, Mr. Jesse H. Lippincott made a proposition to us to undertake the introduction of the Graphophone in the United States. After considerable negotiation we entered into a contract
364 with him, the substantial details of which are known, I presume, to every member of this Convention.

"The organization of the American Company and transposition of the name from 'Phonograph' to 'Graphophone,' incited Mr. Edison to renew his efforts towards securing a practical Phonograph. Finding this to be the case, the feeling became general among the stockholders that it would be better to harmonize the two interests than to have what might prove an injurious competition. Therefore, through Mr. Lippincott,

ENT OF AMERICAN GRAPHOPHONE COMPANY.

American Graphophone Company
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who had then made his first contract with us, an ar- 365
rangement was made with Mr. Edison which brought about this result. The history of the enterprise from that time is known to you all. Either wisely or unwisely, shortly after the enterprise was fully started, the Graphophone was practically withdrawn from the field by the action of the North American Company; and last summer it was proposed to enter into a new contract. I am not going to discuss the policy of having a single machine. If it can be obtained it will be very desirable. I think, however, that too much im- 366
portance has always been attached to that one thing, and that it has tended, more than anything else that has been done, to retard the general talking machine enterprise. The fact is that there is not another patented invention that has not at first been put upon the market in the best way it could be, and then the original machine improved from time to time.

"Reference has been made here to the typewriter. Now, I have used a Remington typewriter almost from the time that my friend here, Mr. Clephane, spent a 367
good many days, weeks and months trying to get the machine into popular use. I bought my machine. I never would have rented it. And I have bought every improved Remington typewriter from that day to this. The Remington typewriter when it was put into use was sold, and, notwithstanding all the improvements that have been made, the selling system has gone on successfully. The sale of machines continues to increase rapidly with each year, and this notwithstanding the competition in typewriters is greater than it ever 368
has been before in the history of the enterprise. If the typewriter people had waited until they had gotten a perfect typewriter, or as good a one as they have today (for it is not yet perfect by any means), its history would no doubt have been quite different.

"With regard to our position, I will state that we have never been approached by the North American Company with any suggestion at all as to our policy, our rights, or as to our construction of the contract be-

369 tween Mr. Lippincott and ourselves. We have never been asked by that company for a single machine; nor have we ever been asked by them whether we recognized Mr. Lippincott's assignments to them or not. The only conversation we have ever had on the subject with any gentleman who might be said to be a representative of that company was with Mr. Bush, who himself suggested to me that our contract with Mr. Lippincott was entirely a personal one; one not capable of assignment to anybody or to any corporation.
370 This conversation was with Mr. Bush, as the attorney of Mr. Lippincott.

"In view of Mr. Lippincott's financial misfortunes, we deemed it important to ascertain just how we stood and we therefore secured the opinions of gentlemen of eminent standing in the legal profession; and, notwithstanding the views of the eminent gentlemen which have been cited here to-day, I say that no lawyer can read the original contract between the American Graphophone Company and Mr. Lippincott without
371 coming to the conclusion that it is a personal contract with that gentleman. There is not an assignable word in it from beginning to end. It calls for Mr. Lippincott's personal exertions, and provides that he is to devote a certain amount of his personal time to the development of the business.

"I desire at this time to correct a statement that has been made as to alleged transactions between the American Graphophone Company and the North American Phonograph Company. I will state, in re-
372 ply to what has been said in the discussion, that the North American Company have never paid the American Graphophone Company one dollar in any shape or form. Mr. Lippincott did at times send us checks of the North American Phonograph Company, explaining that they would answer in place of his own. We have never accepted, and in fact never received, an order from the North American Phonograph Company; we have never had a line of correspondence with that company; we have never shipped a machine at their

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ever shipped a machine at their

request, or recognized them in any shape or form. 373
Not because we did not wish to do it, but simply because we were not asked to do it. Other statements to the contrary are not correct.

"That company have never made an issue with us; have never asked us to recognize any rights they had in any manner, shape or form. It is perhaps just to the American Graphophone Company to say that we did not know of the contents of the contract or assignment of Mr. Lippincott to the North American Phonograph Company of July, 1888, until in January of this 374
year. We knew that there was such a company in existence, and we knew it was organized after Mr. Lippincett got the right to introduce the Phonograph, but at that time, as you all recollect, that interest was stipulated to be conducted under two heads, viz.: the North American Company, under the authority of the North American Company, and under the authority of Jesse H. Lippincott, sole licensee of the American Graphophone Company, the two enterprises being kept entirely distinct. There is not a letter-head or bill- 375
head of any local company printed to-day that does not bear that conclusive evidence upon its face, recognizing the two separate enterprises. The American Graphophone Company have not said that they would not recognize the local companies. They have not taken any position in this matter at all, except in an informal discussion with Mr. Bush, and that discussion with him was not as the representative of the North American Company, but as the attorney of Mr. Lippincott. 376

"The present attitude of the American Graphophone Company is that our contracts with Mr. Lippincott are in force. We are acting under them. We are offering him month by month the five thousand Graphophones a year provided for in the contract, and calling upon him to take and pay for them. We are ready to deliver them whenever they are demanded. What he does with them after he receives them we do not know

377 and do not care, so long as he fulfills his contract with us, and does nothing to injure the enterprise.

"I have said to you, I think, about all that it is proper for me to say. We are ready at all times to answer any inquiries that the local companies or that the North American Company may see proper to make of us. We only desire that such inquiries may be so presented to us that we can deliberately consider them and prepare full answers.

"MR. BOSWELL: As I understand it, there is no an-
378 tagonism at all on the part of the American Graphophone Company towards the local companies.

"MR. PAYNE: Not the slightest in the world.

"MR. BENSON: Perhaps it is proper that I should state that the gentlemen representing the North American Phonograph Company did not say that you would not know the North American Company and the local companies, but that you did not know them.

"MR. PAYNE: I merely state the fact that we have never had any dealings with either of them. I want
379 this Convention to understand that we have never expressed an opinion upon that subject in reply to any question from any source outside. The position we occupy to-day is simply the result of circumstances that have transpired.

"MR. WOOD: Would you have any objection to informing us, as local companies, whether the American Graphophone Company have a new machine made or about to be made?

"MR. PAYNE: I want to say on that point that we
380 have quite a number of Graphophones at our factory, and recognize the justice of some of the complaints that have been made about them, and are trying to improve them. We have men at work at Bridgeport now both on the Graphophone and on the cylinder, and if it becomes a necessity for us to take the field, as it may possibly be, we propose to have a machine that we can offer to local companies, or to agents, with some assurance of success.

"MR. ANDEM: I would like to ask Colonel Payne if

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uld like to ask Colonel Payne if

the American Graphophone Company still recognizes Jesse H. Lippincott as licensee? 381

"MR. PAYNE: We do recognize our contract with him as being still in force. He is entitled to his five thousand machines a year, and can get them at any time he wants them.

"MR. BOSWELL: There is an option with the American Graphophone Company for the purchase of Phonograph patents.

"MR. PAYNE: It was at my suggestion that Mr. Lippincott undertook to buy the Edison rights in 1888, as 382
one mode of combining the two interests and getting them all under one management. We did get a contract from Mr. Lippincott of the character to which you refer. Mr. Edison had assigned all of his patents to the Edison Phonograph Company. Years before Mr. Edison had made an assignment of his fundamental patent to what is known as the Edison Speaking Phonograph Company, a company which did nothing under that assignment, but simply slept on its rights until after the organizatian of the Edison Pho- 383
nograph Company, and the negotiations between Mr. Edison and Mr. Lippincott had been started. Mr. Lippincott did acquire by purchase the Phonograph rights. The contracts are published, and are probably known to all of you. There is no reason, therefore, why I should not refer to them. Mr. Edison agreed to sell the stock of the Edison Phonograph Company, which was the owner of the Edison patents, to Mr. Lippincott for a certain sum of money payable in a certain way. Mr. Lippincott offered that agreement 384
to the American Graphophone Company. The negotiations between Mr. Lippincott and the American Graphophone Company ended in his giving the American Graphophone Company an option to purchase. That is to say, an agreement that they could buy the stock of the Edison Phonograph Company and stock of the Edison Speaking Phonograph Company at any time within five years, at what such stock cost him. That was in August, 1888. Therefore, the American

385 Graphophone Company can, under that agreement, at any time before August, 1893, purchase the Edison rights for what they cost Mr. Lippincott. The agreement was that Mr. Lippincott was to take our stock at par, or was to be paid in cash. That agreement is still in existence. The Edison Phonograph stock went into Mr. Lippincott's possession, was afterwards transferred by him to the North American Company, and by that company redelivered to him, and by him pledged to Mr. Edison as collateral security for a note
386 of his which Mr. Edison holds, and which, I understand, is for part of the purchase money of that same stock. The optional agreement has been recorded in the Patent Office of the United States. It is known to Mr. Edison and was known to the North American Phonograph Company at the time it was made.

"I want to say before the Convention adjourns to-night that it was my intention to go home to-morrow. I came here as a matter of courtesy to this Convention. I mean courtesy on the part of the American Graphophone Company, and
387 unless I can be of some advantage by remaining, I will adhere to my original determination and return to-morrow. My business requires me there. I think if your Committee have any questions to propound or propositions to submit to the American Graphophone Company, that they will be of such a character that they cannot be answered or satisfactorily adjusted in an hour or in a day, but that they will require some deliberation on the part of our company and some deliberation on your part. I therefore
388 suggest it will be better to submit the same in writing, and we will take pleasure in answering as fully and promptly as possible.

"Mr. Dickinson: I move that a vote of thanks be extended to Col. Payne for his courtesy, in appearing before us.

"Col. Payne: I hardly think my coming is deserving of any such notice as that, and modesty would lead me to ask that to be withdrawn.

ıy can, under that agreement,
ıust, 1893, purchase the Edison
st Mr. Lippincott. The agree-
pincott was to take our stock at
id in cash. That agreement is
Edison Phonograph stock went
possession, was afterwards trans-
North American Company, and
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ıe purchase money of that same
ıgreement has been recorded in
e United States. It is known to
known to the North American
at the time it was made.
ore the Convention adjourns to-
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ıe part of the American Grapho-
unless I can be of some advan-
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withdrawn.

" The question being put on the motion, it was unnaimously agreed to." 389

The foregoing report of the remarks of Col. Payne and of the other gentlemen referred to therein is a substantially correct report, according to the best of my recollection. I do not pretend to recall the exact language employed, but do recall the substance of what was said, and I have no doubt the report is an accurate one.

AUG. N. SAMPSON.

Subscribed and sworn to before me this 15th day of December, 1894. } 390

EUGENE H. MOORE,
[SEAL.] Notary Public.

391

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393

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. 394 CLEVELAND WALCUTT ET AL.	In Equity.

Second Affidavit of Thomas A. Edison.

STATE OF NEW JERSEY, }
County of Essex, } ss.:

THOMAS A. EDISON, being duly sworn, deposes and says as follows: I have already given an affidavit in
395 this case.

My attention has been called to an affidavit given for the complainant by Charles S. Tainter, under date of December 6, 1894, and I have carefully read and considered the statements contained in Mr. Tainter's affidavit. I do not feel called upon to repeat my statements about the failure of the graphophone as an instrument of commercial utility; that fact is placed beyond all doubt by the experience of the North American Phonograph Company.

396 The patents Mr. Tainter refers to support the conclusion that the method of recording sound by cutting the record in a composition of beeswax and paraffine, as described in the patents in suit, was an impracticable one. That method was abandoned, as I understand the situation, before the graphophone was put upon the market, and the paper cylinders with an exceedingly thin ozocerite coating were employed with the graphophones that were put out. Ozocerite is somewhat better than beeswax and paraffine, but it is not a fit material for

99

S CIRCUIT COURT,

ICT OF NEW YORK.

COMPANY

ET AL.

In Equity.

F Thomas A. Edison.

S.:

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te is somewhat better than
it is not a fit material for

practical use. It is soft, viscous and readily stretches. 397
It necessarily has these qualities in a high degree to enable it to be coated upon paper and not crack in cooling. Its slight superiority over beeswax and paraffine did not, however, make the ozocerite a practical material.

With regard to the use of carnauba wax, this wax, while exceedingly hard, cannot itself be molded into a cylinder, because its rate of contraction exceeds that of all other waxes and it cracks in cooling. To prevent cracking, it has to be mixed with other and soft waxes, 398
and then the cylinders so made are either too soft or produce scratching noises which make them impracticable. Such is the high rate of contraction of carnauba wax that when coated upon a paper base it must be mixed to so great an extent with soft waxes in order to prevent the mixture from cracking, that the resultant composition is no harder than hard ozocerite. Carnauba wax also lacks utility because it has a tendency to crystallize. In Mr. Tainter's patent the necessity for mixing carnauba wax with a large proportion of soft wax is 399
described. At the time I filed my application upon the employment of carnauba wax, I was having better results with that material than with others which I was experimenting with, but later, when the interference contest arose to which Mr. Tainter refers, I had discovered the impracticable character of carnauba wax and therefore did not contest the interference. As a matter of fact, I did not reach a commercially successful method and material for recording sound vibrations until I began to employ hard soap. 400

With regard to the use of graphophones with ozocerite cylinders at the World's Fair, I do not consider such a use as proving the practical value of the machines, because they were handled by experts and were not in the hands of the public. Further than this, the reports made to me upon the graphophones at the World's Fair were unfavorable to their practical utility.

I have never heard of any graphophones being com-

401 mercially used abroad, although I am a director and vice-president of the Edison United Phonograph Company, which owns the rights under the foreign graphophone and phonograph patents. Several graphophones were exhibited at the Paris Exposition, it is true, but none, so far as I know, have gone into commercial use abroad.

With regard to the use of graphophones in Washington, I have been informed that in the early history of the phonograph business some graphophones were put
402 into use there. Such, however, as were not in the hands of parties interested in the graphophone, were, as I have always understood, soon abandoned. To what extent the use of the few machines remaining in the hands of interested parties was continued I do not know, but the admission by Mr. Tainter that even these machines have been replaced by better ones I understand refers to the fact that they have been replaced by graphophones which, in violation of the contract obligations of the American Graphophone Company, have
403 been provided with the various essential and important features of the phonograph referred to in my former affidavit.

THOS. A. EDISON.

Subscribed and sworn to before me this 17th day of December, 1894.

RICHD. N. DYER,
Notary Public,
State of New Jersey.

[SEAL.]

404

l, although I am a director and Edison United Phonograph Com- e rights under the foreign grapho- ph patents. Several graphophones e Paris Exposition, it is true, but w, have gone into commercial use

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THOS. A. EDISON.

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RICHD. N. DYER,
Notary Public,
State of New Jersey.

405

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
CLEVELAND WALCUTT ET AL.
} In Equity.

406

Affidavit of Alfred O. Tate.

STATE OF NEW YORK, City and County of New York, } ss.:

ALFRED O. TATE, being duly sworn, deposes and says as follows:

I reside in New York City and am the President of the Kintescope Exhibition Company. I was connected with the business of manufacturing and marketing phonographs from the inception of the present business in 1888 until May, 1894, first as secretary of the Edison Phonograph Works, and from August, 1892, to May, 1894, as vice-president of the North American Phonograph Company. In the latter position I had entire charge of the phonograph business for the United States and Canada, which the North American Phonograph Company was conducting. 407

I have read the affidavit of Charles S. Tainter, sworn to in this case December 6, 1894, and have had my attention particularly drawn to what Mr. Tainter says about the use of the graphophone at the World's Fair in 1893, and to the commercial utility of the graphophone. 408

The phonograph was exhibited at the World's Fair by the Chicago Central Phonograph Company, of which I was a stockholder. As a stockholder of that company and as the officer having the active charge of the busi-

409 ness of the North American Phonograph Company, I took great interest in that exhibit and spent considerable time at Chicago. 100 phonographs were there exhibited. The Chicago Central Phonograph Company applied for a concession for 200 phonographs, but the American Graphophone Company subsequently applied for a concession, and the World's Fair authorities gave the right to exhibit 100 phonographs and 100 graphophones.

410 During the course of the Exhibition I took occasion to examine the graphophone with a view of ascertaining its merit, and others connected with the phonograph exhibit did likewise, and reported upon that subject to me. I also heard the comments of many persons who listened both to the graphophone and to the phonograph. As a result, I have no hesitation in stating that the graphophones exhibited at the World's Fair gave exceedingly poor reproductions, and were not machines which would have a commercial utility in the hands of the public.

411 Further than this, I know the fact to be, from the experience of the North American Phonograph Company, that the graphophone which that company attempted to introduce in 1888 and later was not a commercially practical machine, and that the machines which were put out were almost without exception thrown back upon the hands of the company, involving an enormous loss, and this notwithstanding the fact that the North American Phonograph Company was under contract obligations to offer both the phonograph

412 and graphophone to users without favoring either machine. That contract was scrupulously followed until the lack of utility of the graphophone was fully demonstrated.

ALFRED O. TATE.

Subscribed and sworn to before me this 14th day of December, 1894.

EUGENE CONRAN,
Notary Public,
Kings & N. Y. Counties.

[SEAL.]

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ALFRED O. TATE.

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ENE CONRAN,
Notary Public,
Kings & N. Y. Counties.

413.

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
CLEVELAND WALCUTT ET AL.
} In Equity.

414

Affidavit of Robert L. Thomae.

STATE OF NEW YORK,
City and County of New York, } ss.:-

ROBERT L. THOMAE, being duly sworn, deposes and says as follows:

415 I am 29 years of age; reside at Fanwood, New Jersey, and am the secretary of the Kinetoscope Company, of New York. I was connected with the North American Phonograph Company from February, 1889, down to the time that company went into the hands of a receiver, in August, 1894. I was a director of the company during that time. In February, 1889, I was employed in the New York office of that company in charge of the order department, which position I filled until September, 1892, when I went on the road for the company to establish agencies. This I did until 416 April, 1893, when I became the office manager at the Chicago office of that company, where I remained until my connection with the company ceased.

I have had my attention called to an affidavit of Mr. Tainter, in which he states that the early graphophones were a commercial success, and refers to the successful use of the graphophones at the World's Fair in 1893.

I was in Chicago during the World's Fair, and was interested in the Chicago Central Phonograph Company,

417 which exhibited the phonograph at the World's Fair. Due both to my connection with the North American Phonograph Company and to my interest in the Chicago Central Phonograph Company, I was frequently at the Fair, going there some three or four times a week. During that time I not only examined and listened to the graphophones which were on exhibition, but I also heard the comments of many persons who did so. The operation of the graphophones at the World's Fair was very unsatisfactory, and such machines
418 would not have any commercial utility in the hands of the public.

My connection with the North American Phonograph Company put me in position to know the facts with regard to the early history of the phonograph and graphophone business which that company conducted. The experience of that company with the graphophones was that such machines were returned to it in large numbers as unsatisfactory and useless, until nearly, if not quite all, the graphophones it had put out were so returned.
419 Their lack of commercial utility was thus fully demonstrated by the experience of the North American Phonograph Company. The ozokerite record cylinders which were used with the graphophones were not in any sense practical devices. In warm climates they proved too soft for use; in a dry place, such as Denver, the wax cracked and scaled off so that the cylinders could not be used, and under all circumstances they were liable to warp out of shape and thus become useless. The records which were made upon them, in ad-
420 dition, were imperfect and did not give the clear and intelligible reproduction which is required in the commercial use of talking machines.

ROBERT L. THOMAE.

Subscribed and sworn to before me this 15th day of December, 1894.

J. H. MANDLEBAUM,
[SEAL.] Notary Public (298),
New York County.

421

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

422

AMERICAN GRAPHOPHONE COMPANY vs. CLEVELAND WALCUTT ET AL.	In Equity.

Second Affidavit of Cleveland Walcutt.

STATE OF NEW YORK,
City and County of New York, } ss.: 423

CLEVELAND WALCUTT, being duly sworn, deposes and says as follows: I have already given an affidavit in this case.

I have read the affidavit of Charles S. Taintor given for the complainant in this case and sworn to December 6, 1894, and my attention has been especially called to the statements made in that affidavit about the successful use of graphophones in the City of Washington. 424

I recollect that the Graphophone Company had put out a number of graphophones in the City of Washington, the home of that company, prior to the formation of the North American Phonograph Company, and that after the formation of the latter company and the organization of the Columbia Phonograph Company of Washington, which is one of the local licensed companies, the American Graphophone Company billed to Mr. Lippincott these Washington graphophones, and

425 they were in turn billed by the North American Phonograph Company to the Columbia Company on rental, in accordance with the course of business pursued at that time. In this way the graphophones in Washington were turned over to the local company which had the rights for that territory. I also recollect that additional graphophones were billed to the Columbia Phonograph Company on rental, but that, in accordance with the experience with other local companies, the Columbia Company soon began to return these graphophones
426 as unsatisfactory and replace them with phonographs until nearly or quite all the graphophones it had were so returned.

I have examined the books of the North American Phonograph Company to ascertain what are the precise facts in that connection, with the following result:

The books show, under date of December, 1888, that 37 graphophones, which had been put out in Washington prior to the organization of the North American
427 Phonograph Company, had been billed to Lippincott by the American Graphophone Company, and had been rebilled by the North American Phonograph Company to the Columbia Phonograph Company on rental. The books also show that up to May 6, 1890, 402 graphophones, including the 37 machines before referred to, had been billed to the Columbia Phonograph Company, the additional machines having been shipped from the American Graphophone factory. No graphophone was billed or sent to the Columbia Phonograph
428 Company after that date except one machine, which was billed on March 14, 1893, in accordance with a special order. The books also show the number of graphophones returned by the Columbia Company to the North American Company. On May 6, 1890, the date of the last shipment of graphophones to the Columbia Company, except the one machine shipped on special order before referred to, the Columbia Company had returned 157 graphophones. Subsequent to that time, the Columbia Company continued to return

graphophones, until on January, 1893, 401 graphophones had been returned by the Columbia Company to the North American Company, leaving in the hands of the Columbia Company at that time only one graphophone. This one machine and the one machine shipped on special order in March, 1893, have never, so far as the books show, been returned. During this period that the graphophones were being returned, there were several hundred phonographs shipped to the Columbia Phonograph Company by the North American Phonograph Company.

The Columbia Phonograph Company during this period was operating under its contract with the North American Phonograph Company, and such graphophones as it obtained must necessarily have been obtained from the North American Phonograph Company, and the graphophones which were put out in Washington during that time must have been only such as the Columbia Phonograph Company so obtained, because that company had the exclusive rights for Washington, and the American Graphophone Company could not have put out any machines in Washington without violating its contract obligations. Consequently the books of the North American Phonograph Company should make a complete showing as to the graphophones in use in Washington, and my belief is that that showing is a complete one and is a substantially accurate one. If these early machines were replaced by better ones, as stated in Mr. Tainter's affidavit, they must have been replaced by phonographs and not by graphophones.

Referring to Mr. Tainter's statement that the ozocerite cylinders put out with the graphophone were highly useful devices, I wish to say that that statement is not in accordance with the experience of the North American Phonograph Company, through which company the graphophones and ozocerite cylinders were attempted to be marketed. The graphophones which were returned by the various local companies

433 were so returned with the complaint that they were not serviceable. Many grounds for this complaint were stated by the local companies, but one of the most important grounds and the one most frequently urged was that the cylinders themselves were not serviceable for many reasons, and including the reason that the records made upon them were not clear and intelligible in their reproduction.

CLEVELAND WALCUTT.

434 Subscribed and sworn to before me this 17th day of December, 1894.

EUGENE CONRAN,
[SEAL.] Notary Public,
Kings & N. Y. Counties.

435

436

437

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHNE COMPANY vs. CLEVELAND WALCUTT ET AL.	In Equity.

438

Affidavit of Richard N. Dyer.

STATE OF NEW YORK, }
City and County of New York, } ss. :

RICHARD N. DYER, being duly sworn, deposes and says as follows :

I am one of the counsel for the defendants. I have read the affidavit of Philip Mauro given for the complainant under date of December 7, 1894. 439

In February, 1893, the complainant brought suit against the Columbia Phonograph Company, in Washington, and against the Edison Phonograph Works, in New Jersey, on the patents here in suit. Answers were filed in such cases in May, 1893, as stated by Mr. Mauro. Those answers, in addition to the defences referred to by Mr. Mauro, also set up licenses from the complainant under the patents in suit. The complainant took testimony in the Washington case, but it was not until July, 1894, that the complainant closed its *prima facie* proofs in that case. It is not my understanding of the matter that the Washington case was selected by arrangement between counsel to try the issues raised. The complainant proceeded, however, to take testimony in that case, and by a stipulation made in July, 1894, the parties had the right to file in either case the testimony taken in the other. The complainant, however, did 440

441 not file its testimony taken in the Washington case in the New Jersey case until November of the present year, and has never taken a single line of testimony directly in the New Jersey case.

The defense of the two suits referred to was undertaken by the North American Phonograph Company. That company went into the hands of a receiver in August, 1894, and was financially embarrassed for some time prior to that time, and when the complainant closed its *prima facie* testimony in the Washington
442 case in July, 1894, we did not feel warranted in proceeding at once. After the receiver was appointed we endeavored to get him to proceed with the litigation, but he finally refused. The defense in the New Jersey case was thereupon undertaken by the Edison Phonograph Works, for which company we have since acted as counsel. The Columbia Phonograph Company, however, did not employ us as counsel in the Washington case, and we withdrew from that case, as stated in Mr. Mauro's affidavit.

443 We had a further reason for wishing to retire from the Washington case. We have always believed that the Washington suit was intended to be a collusive one, since the complainant and defendant are companies managed by the same persons, and working together in a common interest. If antagonistic at all, they are so only in a technical sense. If the complainant had wished to raise the issues which could be raised by a suit against one of the local licensed companies, there existed a number of such companies against which suits
444 could have been brought without bringing suit against the particular local company which was controlled by the same interest as the complainant. The North American Phonograph Company, however, as the parent company, felt called upon to intercede and make an honest defense; but, when we had prepared our answer and attempted to get the Columbia Company to sign it, the officers of the Columbia Company refused to sanction the allegations of the answer which attacked the validity of

the complainant's patents, set up non-infringement, license, etc., and it was only by securing an order of the court at Washington that we finally succeeded in getting the answer signed and sworn to. This incident and other matters showed us so clearly the collusive attitude of the Columbia Company that, when the receiver of the North American Phonograph Company finally decided that he would not carry on the defense, we withdrew from the case in the most formal manner and as quickly as we could. 445

I quite agree with Mr. Mauro that the issues raised in the present case could have been tried in the suits brought in February, 1893, before this time, or such cases could at least have been well advanced towards final hearing. Had he taken his testimony in the non-collusive suit against the Edison Phonograph Works, we would have met him promptly, and had that testimony been taken early in 1893, as it might have been if Mr. Mauro had seen fit so to do, we would certainly have taken our testimony within a reasonable time. The fault, we think, was the complainant's, first, in selecting the collusive case to proceed with, and, second, in not proceeding promptly. The fact remains that the complainant has had suits pending upon the patents in suit since February, 1893, without making any material progress in the cases, and without moving for preliminary injunction against any of the various persons and corporations which, according to the complainant's view of the matter, are now and have been infringers of complainant's patents until the motion was made against the United States Phonograph Company, which was argued before his Honor Judge GREEN December 4, 1894, and the motion in the present case. 446 447 448

RICHARD N. DYER.

Subscribed and sworn to before me this 17th day of December, 1894.

EUGENE CONRAN,
[SEAL.] Notary Public,
Kings and N. Y. Counties.

449

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

450	AMERICAN GRAPHOPHONE COMPANY vs. CLEVELAND WALCUTT ET AL.	In Equity.

Second Affidavit of Richard N. Dyer.

STATE OF NEW YORK,
451 City and County of New York, } ss.:

RICHARD N. DYER, being duly sworn, deposes and says as follows;

I have already given an affidavit in this case. I have in my possession copies of the various contracts entered into by Mr. Edison relating to the phonograph, and among them are the contracts entered into by him in January, 1878, with the organizers of the Edison Speaking Phonograph Company, which company was incor-
452 porated to exploit his invention of the phonograph. Those contracts of January, 1878, contain a description of Mr. Edison's invention in the following language, which is taken from the preamble of one of the contracts:

"Whereas, the said party of the first part [Edison] is the inventor of a new method for recording and reproducing therefrom the human voice and other sounds by causing such sounds to vibrate a mobile body, the movements of which are recorded by indentation, dis-

S CIRCUIT COURT,

RICT OF NEW YORK.

: COMPANY
ET AL.
} In Equity.

of Richard N. Dyer.

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ew York, } ss.:

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placement, subtraction from or deposit upon any material, and the reproduction of the movements of said mobile body by causing its record or a copy thereof to give motion to another or the same body." 453

I append hereto a complete copy of the opinion of Mr. Thurston, which is referred to in the affidavit of complainant's witness Charles J. Bell, and is also referred to in Mr. Edison's affidavit.

RICHARD N. DYER.

Subscribed and sworn to before me this 19th day of December, 1894. } 454

EUGENE CONRAN,
Notary Public,
[SEAL.] Kings and N. Y. Counties.

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Opinion of Benjamin F. Thurston.

PROVIDENCE, January 20, 1890.

MESSRS. SPENCER TRASK & CO.:

DEAR SIRS—I have examined, at your request, the several letters patent relating to the Edison phonograph, and also the several letters patent relating to the graphophone, with the view of ascertaining whether the fundamental patents for the phonograph and the graphophone cover essentially the method and practical apparatus for recording and reproducing sounds, including articulate speech.

I understand that all machines constructed for use in this country and Canada under the phonograph and graphophone patents are, under existing contracts between the parties, now under the control of The North American Phonograph Company.

The important inquiry is whether the underlying patent to Edison, No. 200,521, dated February 19, 1878, for the phonograph, and the underlying patent to Bell & Taintor, No. 341,214, dated May 4, 1886, for the graphophone, practically cover and control the whole art. The many patents subsequently taken by the parties in interest relate to improvements upon the original ideas expressed in the Patents Nos. 200,521 and 341,214. It will be unnecessary to consider such subsequent patents in detail, the important consideration being whether the underlying patents mentioned control the art.

The Edison Patent of February 19, 1878, absolutely stands at the head of the art for recording sounds, including articulate speech, and retranslating such record at pleasure back into sounds or speech. There is no suggestion in any prior patents or publications which have come to my knowledge of the discovery set forth in the said Edison Patent, or any suggestion of an apparatus which would embody such discovery.

The rule which applies to the interpretation of primary patents, or those which stand at the head of a discovery in the arts, has been recently established em-

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.mon F. Tharston.

VIDENCE, January 20, 1890.

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underlying patents mentioned

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would embody such discovery.
lies to the interpretation of pri-
which stand at the head of a
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phatically by the Supreme Court of the United States, 461
and that rule is this: That wherever an inventor or discoverer has struck out an entirely new path by discovering a law of nature or of physics and has utilized it in some practical way for the benefit of man, the broadest interpretation in favor of his invention against parties coming subsequently into the art as improvers of the apparatus in the same is given in favor of such primary inventor, and those coming after him are held tributary. Various decisions of the Supreme Court have indicated through a series of years this rule, but 462
it was expressly formulated in the case of the *Morely Sewing Machine Co. vs. Lancaster, 129 U. S., 263.* The Court, in announcing its decision and judgment in this case, affirmed the following cases, which embody substantially the same principle, although their expression is not as unqualified and positive as in the case to which I have referred: *McCormick vs. Talcott, 20 Howard, 402; Railway Co. vs. Sayles, 97 U. S., 554; Clough vs. Barker, 106 U. S., 166; Consolidated Valve Co. vs. Crosby Valve Co., 113 U. S., 157; Tilghman* 463
vs. Proctor, 102 U. S., 707.

The broad doctrine applicable to the Edison Patent No. 200,521, cannot be better expressed than by quoting the language of Mr. Justice BRADLEY in one of the cases above cited:

"If one inventor precedes all the rest and strikes out something which includes and underlies all that they produced, he acquires a monopoly and subjects them to tribute."

In my opinion, this is the status of the Edison Pat- 464
ent No. 200,521, of February 19, 1878. It was the first suggestion of the possibility of converting articulate speech into a permanent graphical representation of the same corresponding in a general way with the forms of the sonatic waves, and then reproducing at will such speech by reconverting such graphical expressions of the same into sound.

The Letters Patent to Bell & Taintor, No. 341,214, dated May 4, 1886, while based upon the prior inven-

tion of Mr. Edison, are, in my opinion, most important as exhibiting an improvement in the apparatus by which the discovery of Edison could be utilized, which places this patent in a most important relation to the art. It is unnecessary to deal in detail with this patent, further than to say that it proposed to employ a register made of some suitable material, upon the surface of which the graphical representation of the sound waves should be formed by sharply cutting into the register the lines corresponding with the transmitted sound. The improvement which is embodied in this patent is practically, in my opinion, of great value in producing satisfactory apparatus to exhibit the fundamental discovery of Edison. While, indeed, upon the expiration of the Edison Patent, the general discovery will be open to the public to use at its pleasure for commercial purposes, the invention set forth in the Bell & Taintor Patent will prolong, in my opinion, practically the monopoly.

The only matter of which I know, or which has been brought to my attention, as bearing at all upon the subject of the discovery of Mr. Edison, is a publication contained in the Bulletin of the National Society for the Encouragement of Industry in France. This publication merely exhibits a capacity of the apparatus described therein to record graphically articulate speech or other sounds. The apparatus was analogous to a device for a similar purpose already known in the mechanic arts, of which the Watts indicator, for the purpose of graphically indicating in a diagram a figure from which the power of the steam engine could be calculated, is a familiar illustration. No further use was made of this apparatus than to exhibit to the eye a representation of the movements of the stylus under the varying influences and pressures of the human voice controlling the movements of the stylus. The invention of Edison was quite different from this. He may indeed have used this old idea for the purpose of obtaining a record, but so far as I know, or have been advised or believe, he was the first person to conceive

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the idea that such graphical expressions of sound could 469
be reconverted into speech, and this discovery is the
marvel of the phonograph.

Mr. Edison, as well as Bell & Taintor and Alexander Graham Bell, have taken a large number of patents in the aggregate since the date of the original Edison Patent, February 19, 1878. All these several patents relate to improvements in the apparatus for developing and exhibiting the discovery. It is unnecessary to examine into the history of each of them and to compare them with anything which precedes, because they are 470
only preceded by themselves. The whole art, in its original conception, as in its development, is, as I understand, expressed in this body of patents, the benefit of which is vested in The North American Phonograph Company. Hence an investigation into them individually, which might become necessary under other circumstances, becomes entirely unimportant in the present condition.

I am, therefore, of opinion, that the body of patents relating to the phonograph and the graphophone, 471
which are merely different names for apparatus to display the same grand discovery, cover the whole subject of recording speech and reproducing the record back into speech to an extent that in my experience I have never known paralleled.

I have also examined, at your request, the agreement between Thomas A. Edison and Jesse H. Lippincott of June 28, 1888, the agreement between Lippincott and The North American Phonograph Company of July 17, 1888, and the agreement of Edison with the North 472
American Phonograph Company and with Lippincott of August 1, 1888. The first named of these agreements recites that the corporation the Edison Phonograph Company is the owner of the Edison phonograph patents, and that the Edison Phonograph Works has the exclusive right to manufacture phonographs under a contract between it and Edison, and for a consideration therein named Mr. Lippincott agrees to purchase the entire capital stock of the Edison Phonographic Com-

473 pany, with the exception of one hundred and fifty shares. These one hundred and fifty shares, as I am advised, have now also been acquired by Mr. Lippincott. The agreement contemplates that the American Phonograph Company shall be formed by Mr. Lippincott within a limited period, and in fact, as I am advised, this part of the agreement has been executed by the organization of The North American Phonograph Company. On the other hand, Mr. Edison agrees, under certain conditions named in the contract, to
474 transfer the entire capital stock of the Edison Phonograph Company, with the exception of the one hundred and fifty shares mentioned.

The second agreement of July 17, 1888, between Lippincott and the North American Phonograph Company, after reciting the fact that he is the owner of rights under the various Edison patents and the patents to Bell and Taintor and to A. G. Bell, provides that Lippincott shall sell and transfer all the rights which he has or may thereafter acquire under the patents
475 and inventions of Edison, and generally all rights in the subject matter of phonographs and graphophones, to The North American Phonograph Company for a consideration to be paid to him in capital stock of said company, and it also contains a covenant of further assurance to more fully effectuate and carry out, if necessary, the true intent of the agreement, so as to vest in the company all the rights, property, privileges and license acquired by Lippincott.

The third agreement between Edison, The North
476 American Phonograph Company and Lippincott, specifies certain provisions under which the machine shall be put upon the market. The important clause, however, in the provision is that Edison agrees to convey any invention or improvement made by him on the subject of the phonograph within a period of fifteen years to The North American Phonograph Company without further compensation.

All these above-mentioned agreements contain various provisions relating to the business matters in which

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the parties are interested, but which do not affect at 477
all the question of the validity of the rights under the phonograph and graphophone patents vested in The North American Phonograph Company. I have directed my attention simply to the question whether under the existing agreements the control of the rights to use and dispose of machines under the patents relating to the phonograph and the graphophone will become vested in The North American Company on the performance of the contract stipulations contained in said agreements. In my opinion, if the conditions 478
specified in such agreements are performed, the control of such rights under the patents relating to both the phonograph and the graphophone will become lawfully vested in The North American Phonograph Co.

I am informed by Messrs. Witter & Kenyon, who are counsel for Lippincott and for The North American Phonograph Company, that all the conditions as to the payment of the consideration for the rights under the Edison phonograph patents have been fully performed, with the exception of the final payment of about sixty 479
thousand dollars by Mr. Lippincott, which is to be paid on the first day of April next.

The general chain of title to the graphophone patents appears, from copies submitted to me of the agreements, to be as follows: The title to the patents is vested in the Volta Graphophone Company of Alexandria. The American Graphophone Company was organized by certificate of incorporation on the 15th of May, 1887, and to this company the Volta Graphophone Company granted an exclusive license to make and sell 480
graphophones. Subsequently, on March 26, 1888, the American Graphophone Company, by agreement with Jesse H. Lippincott, granted to him the right to sell and use in the United States and Canada all the graphophone instruments and supplies manufactured by the American Graphophone Company, with the exception of the States of Illinois, Wisconsin and Michigan. Lippincott, under the agreement before referred to with The North American Phonograph Company, of July 17th, 1888,

granted to said company all the rights which he had, or should thereafter acquire, in virtue of the agreement of March 26, 1888, whereby it follows that The North American Phonograph Company have the sole right of using and placing the machines manufactured and delivered to them by the American Graphophone Company. On the 6th of August, 1888, a supplemental agreement was made between the American Graphophone Company and Jesse H. Lippincott, whereby a prior agreement between him and the company was enlarged so as to enable him and The North American Phonograph Company, as assignee, to deal with phonograph instruments as well as graphophone instruments, such prior agreement precluding him, until the modification expressed in this instrument, from dealing in other instruments than the graphophone.

The substance of the agreements with respect to the phonograph and the graphophone, so far as relates to the rights of The North American Phonograph Company, may be summarized as follows: The title to the Edison phonograph patents resides in the Edison Phonograph Company. The title to the graphophone patents resides in the Volta Graphophone Company. The exclusive right to manufacture Edison phonographs under these patents resides in the Edison Phonograph Works. The exclusive right to manufacture graphophones is vested in the American Graphophone Company. The exclusive right to use, lease and sell both the phonograph and the graphophone is vested in The North American Phonograph Company. The continuance of these rights depends upon the performance of the conditions of the several agreements upon which these rights are based.

I have not felt it necessary to go through and detail these several agreements beyond stating their general effect.

Inventions made by Mr. Edison subsequent to August 1, 1888, are to be conveyed to The North American Phonograph Company.

Very respectfully,

BENJ. F. THURSTON.

A.D. 1877, 30th JULY. N° 2909.

SPECIFICATION

OF

THOMAS ALVA EDISON.

CONTROLLING BY SOUND THE TRANSMISSION OF ELECTRIC CURRENTS, AND THE REPRODUCTION OF CORRESPONDING SOUNDS AT A DISTANCE.

PRINTED BY ORDER OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS.

LONDON:

PUBLISHED AND SOLD AT 38, CURSITOR STREET, CHANCERY LANE, E.C.

Price 8d

1878.

A.D. 1877, 30th JULY. N° 2009.

Controlling by Sound the Transmission of Electric Currents, and the Reproduction of Corresponding Sounds at a Distance.

LETTERS PATENT to Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, for the Invention of "IMPROVEMENTS IN INSTRUMENTS FOR CONTROLING BY SOUND THE TRANSMISSION OF ELECTRIC CURRENTS, AND THE REPRODUCTION OF CORRESPONDING SOUNDS AT A DISTANCE."

Sealed the 20th October 1877, and dated the 30th July 1877.

PROVISIONAL SPECIFICATION left by the said Thomas Alva Edison at the Office of the Commissioners of Patents on the 30th July 1877.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN INSTRUMENTS FOR CONTROLING BY SOUND THE TRANSMISSION OF ELECTRIC CURRENTS, AND THE REPRODUCTION OF CORRESPONDING SOUNDS AT A DISTANCE."

The vibrations of the atmosphere, which result from the human voice or from any musical instrument or otherwise, are made to act in increasing or lessening the electric force upon a line by opening or closing the circuit, or increasing or lessening the intimacy of contact between conducting surfaces placed in the circuit at the receiving station; the electric action in one or more electro-magnets causes a vibration in a tympan, or other instrument similar to a drum, and produces a sound, but this sound is greatly augmented by mechanical action.

I have discovered that the friction of a point or surface, that is in contact, whether a properly prepared and slowly moving surface, is very much increased or lessened by the strength of the electric wave passing at such point of contact, and from this variation in the friction a greater or less vibration is given to the mechanism or means that produce or develope the sound at the receiving station, thereby rendering clear and distinct the sound received that otherwise would not be audible.

To carry out the peculiarities of my Invention under the varying conditions of use, I have devised several modifications of the transmitting, receiving, and intensifying devises employed in this sound telegraph; portions of the apparatus

Price 8d.]

are interchangeably, available in transmitting or recording; others are adapted to local use; some are only available in transmitting, and others are only for receiving; and some portions of my improvement can be availed of to make a record of the atmospheric sound waves, or of the electric waves, or pulsations corresponding thereto or resulting therefrom.

In one form of my apparatus the sound passes into a resonant box having one, two, or more tympans at its sides that are vibrated thereby, the tension of these being various, so as to respond to different sound waves, and the electric connection pass through all to one line or circuit, in which is a battery and the distant receiving instrument. Circuit contact points are provided at one or both surfaces of the tympan or tympans; the tympans are of parchment, foil, mica, sheet metal, or similar material. I find platinum, foil, or mica to respond advantageously when the waves from the mouth are made to pass through a slot resembling the larynx placed within the resonant tube. The contact points or surfaces are sometimes metallic, but plumbago, or similar semi-conducting material, into which the tympan or diaphragm is brought more or less intermittently into contact, or a point or pin thereon serves to lessen or increase the electricity passing at that point.

In the receiving portion of the instrument the tympan is acted upon directly by an electro-magnet, or through an armature, or the tympan is provided with an arm extending out over a slowly moving surface or cylinder, and the electric current, passing at the point of contact, increases or lessens the friction, and produces the vibration of the arm and tympan in proportion to the difference of friction developed between the arm and moving surface by the passage and cessation of the current through the chemically prepared paper, preferably moistened with a salt of mercury and an alkali. This feature is capable of very extended developement in telegraphy; the clearness and extent of sound produced by the receiving tympan exceeds anything heretofore attained in acoustic telegraphs.

The frictional surface may be any material which absorbs liquids, such as chalk or paper; the transmitting points in all instances should be a poor conductor of electricity, such as cyanide of copper, peroxide of lead, or plumbago, which substance may be moulded with non-conductors.

Where plumbago is used between the cores and armature of an electro-magnet, and such plumbago is included in a local or relay circuit, the pulsations or rise and fall of electric tension will correspond to that in the coils of the electro-magnet in consequence of the varying compressing action on the plumbago or similar material, which increases and decreases its resistance.

A polarized arm, near a soft iron plate upon the tympan, will receive a motion from the vibration of the tympan, and make more or less intimate contact with the plumbago point without arresting the motion of such tympan.

In the line the effect of the static charges and discharges are neutralized by condensers or by helices in shunts.

Where a rapidly revolving wheel is contiguous to the transmitting tympan, and there is a plate of platina on that tympan to which the circuit is connected, the rise and fall of electric tension will result accurately from the movement of the tympan, producing greater or less contact with the wheel; a spring may intervene between the wheel and tympan.

A spring or reed, attached to a stud at one end, and to the tympan at the other, is vibrated or undulated by the sound waves acting on the tympan, and produces greater or less contact with pieces of tin foil surrounding it, which also are in the electric circuit or plumbago; contact points near the side of such spring effect the same object. A column formed of disks of tin foil in a glass tube, pressed upon by the vibrations of the tympan, also are employed under some circumstances to regulate the electric tension in the circuit.

The moving surface, whose friction is increased or decreased upon the passage and cessation of the current aforesaid, is employed in some instances to vibrate by the electric and mechanical action a frame of strings of different pitch to produce musical sounds, or to give motion to reeds or resonant boxes.

The transmitting tympan is sometimes made of cloth, with plumbago pressed into its surfaces, and generally it is preferable to weight the centre of the tympan, and take the motion a little one side of the centre to prevent a flase movement or rebound. These sound transmitting and receiving instruments are applied in single or multipleyd telegraphs; the connections through the Wheatstone bridge, or the induction coils, being used in the well known ways, and the circuits being either single or relays.

Where alluminium is introduced in the electric circuit in connection with a material containing an electrolite, the vibration of the tympan, and an extension from it to the material containing the electrolite, causes a depolarization at the point of contact at every vibration, thus increasing and decreasing the strength of the current by depolarization.

Where a slot is made in the diaphragm, and the airways impinge against the same, the vibration of the hissing sounds is augmented.

The resonant chamber for convenience is made portable, so as to be presented to the mouth.

In addition to the tympan for transmitting the vowel sounds, I employ another opening in the speaking tube or chamber, which opening may be increased or lessened; I stretch edgewise over this a thin reed of foil, which is set in vibration by all hissing consonants, and make contact with a plumbago point, or with a platina point, which is connected to the line through an adjustable resistance coil, or a self-acting reed giving a hiss may be thrown in and out of circuit by the movement of the foil reed.

For transmitting and receiving letter by letter, I employ a shaft with 30 wheels, and contact springs resting upon them; the wheels are provided with teeth of such number and character that they will cause the springs to be vibrated against a plumbago point the necessary number of times, and with proper pressure to transmit the letter, which is rendered audible at the distant station by the magnet or frictional surface. Each wheel is controlled by a key of a key board.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Thomas Alva Edison in the Great Seal Patent Office on the 30th January 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN INSTRUMENTS FOR CONTROLING BY SOUND THE TRANSMISSION OF ELECTRIC CURRENTS, AND THE REPRODUCTION OF CORRESPONDING SOUNDS AT A DISTANCE."

This Invention relates to that class of electrical instruments in which sound becomes one of the elements in the transmission of the communication, and the same sound is produced at the receiving station, so that oral communications can be sent by electricity and clearly distinguished at the receiving station.

Musical tones may also be sent, but my present Invention is especially available in transmitting and receiving oral communications.

In transmitting musical tones, the respective notes each have a definite period for each vibration, hence there is a response at the receiving end from the notes that vibrate in time with the electric pulsations sent, but in speaking there is little change in the musical tone, but considerable in the modulations and inflections of the voice.

In my present Invention I make use of the vibrations given to a diaphragm or tympan, by speaking into a resonant case, to produce a rise and fall of electrical tension upon the line with such accuracy that the electric pulsations or waves will represent the atmospheric sound waves produced by articulation, and the electro-magnet at the receiving station will respond to the electric waves in such a manner as to reproduce the articulation by acting upon a resonant plate.

The instruments in a complete form are represented in Figs. 1 and 2, Fig. 1 being a section of the transmitting instrument, and Fig. 2 of the receiving instrument.

The resonant tube or box *a* is of a size and shape adapted to being spoken into, the same having an opening at one end or side and a diaphragm or diaphragms *b*, against which the sound waves from the human voice act, and these and the motion that the diaphragm receives is the means of producing a rise and fall of electric tension on the line by the devices hereafter set forth, so that the battery B connected to the line *l* will transmit a greater or less current to the distant electro-magnet *m*, Fig. 2, and increase or lessen the magnetism of the cores, and in so doing act upon a resonant plate *c*, and develop sound corresponding to the articulation at the transmitting station.

The general features thus described pervade my entire Invention, but in developing the same many useful and important modifications and variations have been made, which I will proceed to set forth.

For convenience the speaking instrument, Fig. 1, is provided with a handle, a^1, and flexible conductors to the battery and line respectively, so that it may be handled and brought to the mouth; and in like manner it is preferable to place the hearing instrument, Fig. 2, in a movable handle b^1, so that it can be placed with the plate *c* against the ear, this brings the sound close to the organs of hearing, and the resonant plate touching the ear increases the distinctness of the sound, and prevents any false or prolonged vibrations of the plate.

In some of the modifications I have shown the speaking instrument as a fixture, and also the hearing instrument as a fixed resonant tube, these being variable to suit the persons or the places.

The first especial feature that requires separate consideration is the peculiarity of the resonant tube for the voice. I have experienced great difficulty in reproducing the sound of the hissing consonants, such as *s*; this appears to arise from the fact that this sound is deflected downwardly in leaving the mouth, and does not act distinctly upon the diaphragm. By providing an edge in the resonant tube below the mouth, upon which such consonant sounds are received, the vibrations

are given either to the resonant tube or deflected to the diaphragm. I find it preferable to employ a hole *e* at the lower part of the mouth-piece, against the edges of which the downward sound waves are directed. The same effect will be produced by a vibrating edge placed in the lower part of the mouth-piece, or the opening into the resonant box may be contracted to about half an inch in diameter to effect the same purpose. The next feature requiring consideration is the character of the diaphragm in the speaking instrument.

Many materials have been employed by me, such as metals, horn, vellum, celluloid, ivory, &c., but almost all of these produce a prolonged or secondary vibration from their own resonant character, hence the articulation is defective, and the sound vibrations blend.

After extensive experiments I find that mica is almost entirely free from any resonant action, and hence it will respond with the greatest accuracy to the sound vibrations, and being of a laminated character can be employed of any desired thickness, and when secured at its edges responds with the greatest accuracy to the sound vibrations, and does not require to be strained; furthermore, the changes of temperature and atmospheric condition have little or no effect upon the mica diaphragm or tympan.

I find that it is not practical to open and close the line circuit in instruments for transmitting the human voice; the circuit to the line must be always closed, and the transmission be produced by a rise and fall of electric tension, resulting from more or less resistance in the line. This resistance may be produced in several ways. I have shown several which will hereafter be named, but I find the most delicate to be small bunches or tufts, or disks of semi-conducting elastic fiber, such as particles of silk, and an intermediate conducting or semi-conducting material; this device I call an electric tension regulator; it is more or less compressed, according to the vibrations of the diaphragm or tympan, and the electric current rises in tension as it is compressed or lessens as the fiber expands. This fiber is placed in a small roll *t*, between the delicate diaphragm spring *u*, Fig. 9, and the variable presser *v*, adjustable by a screw or otherwise in the electric circuit at this point it may be within a cavity in said presser *v*, as in Fig. 1, there being a delicate contact center piece *w* to the diaphragm *b*, with a piece of platina foil *x* in contact with the fiber; in all instances the telegraphic circuit at the diaphragm is made by a thin strip of platina or similar material extending to the center from the line or battery connection.

The fiber is rendered semi-conductive by being rubbed with plumbago, soft metal, or similar material, or by a deposit of metal upon its surface, or by fine particles of conducting or semi-conducting material mixed with it, the conducting power varying with the density of the tuft or bunch of fiber. The delicate spring *u*, Fig. 9, upon the mica diaphragm *b* is easily secured by solder passing into fine holes bored in the mica. In Fig. 3 the tension regulator is made by water or other semi-conducting electrolytic fluid in a cup *f*. The wires to the battery are led to the electrodes or conducting points 2, 3, in such cup that are opposite to points 4, 5, upon the diaphragm *b*. The cup is adjustable to vary the distance between the electrodes and the rise and fall of tension results from the varying distance between the electrodes as moved by the vibrations of the diaphragm.

If there are several electrodes opposite to each other and insulated, except at their ends, and the circuit led from one to the other so that the current passes through all the electrodes in succession, the rise and fall of electric tension will be promoted, because the smallest vibration of one set of electrodes is multiplied by the number of places at which the metallic circuit is interrupted or varied.

In the receiving or hearing instrument the resonant plate *c* should be of tinned iron, resting upon the edges of the case, and the magnet *m*, adjustable nearer to or further from the same, and connected loosely by slotted tongues. This plate will respond to the electric pulsations by the attraction of the magnetized cores, and the sound resulting will be audible when the plate is placed near or against the ear. If the plate is pressed away from the magnet by a delicate spring or allowed to fall

away from the magnet, the instrument may be used as a call by using a key or switch at the sending station to open and close the circuit, and thus move the plate to give a loud sound.

In some cases I make use of a variable resistance resulting from greater or less intimacy of surface contact such as would result from a disk covered with plumbago placed adjacent to a diaphragm, also covered with plumbago or other semi-conducting material, so that the proximity or extent of surface contact will produce rise and fall of tension, the respective parts being in the telegraphic circuit. I also sometimes employ a shunt circuit in the line, or a branch circuit to the earth, in which is placed an electro-magnet to neutralize any static charge or discharge in the line.

I sometimes perforate the diaphragm 10, Fig. 18, and place a strip of elastic material, 40, across said diaphragm over the hole, and upon this a piece of foil, so that the same responds to very weak vibrations, and in some instances two or more diaphragms are provided at different sides of the resonant box, each with its own tension regulator, the diaphragms being either the same or of different sizes, characters, or tensions, so as to respond to varying sounds or acoustic condition, the various tension regulators being all in the electric circuit; this will produce greater rise and fall of tension for longer lines in consequence of the diaphragms acting simultaneously on the tension regulators.

In some instances it is preferable to make the mouth-piece of the speaking instrument sufficiently large or flaring to receive all the sound vibrations, whether coming from the mouth, nose, or throat.

Several contact points of platina, placed contiguous to the diaphragm, may be used, the same acting to increase or lessen the surface contact, according to the amplitude of vibration of the diaphragm, and a drop of liquid such as oil or glycerine, between the contact point and diaphragm, will serve to maintain a closed circuit, but the movement of the diaphragm produces rise and fall of tension.

The tension regulator, formed of fiber and conducting or semi-conducting material, may be either dry or moistened with a liquid.

In some instances I make use of the best quality of lamp black retained within a case to form the tension regulator, the circuit passing through the same, and the rise and fall of electric tension resulting from the compression of the same by the movement of the diaphragm.

I am enabled to record to record the sounds produced by the human voice or otherwise by causing the movements of the diaphragm to be registered on paper or soft sheet metal, and then the paper may be used in an instrument to reproduce the sound upon a delicate diaphragm by giving to the same a vibration similar to that originally given by the voice.

h, Fig. 4, is the indenting transmitter, the diaphragm having a knife-edge point. *i* is the paper which has previously been passed through a machine to raise a V shaped rib 6. The movement of the diaphragm of *h*, when the drum is in motion, causes the knife-edge point l^1 to indent the raised rib to varying depths, according to the amplitude of vibration of the diaphragm, thus these indentations represent accurately all the tones and varying inflections of the human voice. The paper after being indented is passed through a second apparatus *n*, Fig. 5, almost similar to *h*. A spring 9 has a knife edge which rest upon the raised indented rib 6, the spring being connected to a delicate diaphragm 10 by a string or straw.

The indented rib reproduces in the spring 9 the movement of the indenting point, and either by direct action, or through the vibration of a string, conveys the same motion to the diaphragm of *n*, and reproduces previous sounds. If these sounds are to be transmitted over a telegraph line the diaphragm 10, see Fig. 6, is provided with a cork disk *w*, and fibrous tension regulator *t*, before described, to produce the rise and fall of electric tension on the line. The sound may be recorded in ink as represented in Fig. 7. The diaphragm of *h* operates a very flexible self-feeding pen *o*, and causes the continuous line to be wide or narrow, according to the amplitude of vibration of the diaphragm. The ink used should dry quickly,

and the strip may be passed at any time thereafter through the instrument shown in Fig. 8, beneath the arm 12, having a point or points resting on the paper; this arm is connected with a resonant diaphragm, and the ink marks produce more or less friction, according to the breadth and amount of ink deposited, and this will set the diaphragm of n vibrating, and reproduce the vibrations of the diaphragm of h.

An obvious modification would be to coat the paper with a substance which would cause considerable friction, or even rough unsized paper might be used, and a spring provided with a burnished point, rather flat, would cause the surface of the paper to be made smooth more or less, according to the vibration of the diaphragm, and the differences in the surface of the paper would produce a response in the receiving diaphragm.

I sometimes arrange the battery in connection with the transmitting instrument, as shown in Fig. 10.

h is the resonant chamber at the end of which is the diaphragm 10, and at each side of this diaphragm there are springs c^2, c^3, having points made of compressed plumbago mixed preferably with gum rubber, but any substance not liable to rapid decomposition, or the elastic or fibrous tension regulator aforesaid may be used. These points face each other on opposite sides of the diaphragm, and make contact with platina foil disks secured to the diaphragm.

The spring c^2 passes through a hole or small slot in the side of the chamber h.

d^2, d^3, are the main batteries. The battery d^2 has zinc to the line or spring c^2, and the battery d^3 has copper to the line or spring c^3. When the springs c^2 and c^3 are adjusted to make contact with the diaphragm equally, no current passes to the line; but when the diaphragm is vibrated, its movement to one side, say c^2, causes a greater pressure upon the plumbago on that spring, and a lessening of the pressure on the plumbago on c^3; hence the balance of the batteries c^2 and c^3 will be destroyed, c^2, having the advantage, will send a negative current to line; upon the return of the diaphragm the battery currents will again neutralize each other. The vibration of the diaphragm to the other side causes the pressure to be reversed, and the battery d^3 will send a positive current to the line.

As the tension regulator of fiber or of plumbago decreases and increases its resistance enormously under slight changes of pressure, it follows that the strength of the electric waves will be in proportion as the speaker's voice is strong or weak.

In Fig. 11 is shown the contact spring, which may be used adjacent to the diaphragm at one or both sides thereof. c^3 is a U shaped spring secured to the screw c^4, which is adjusted back and forth by the thumb nut c^5; c^6 is the pillar holding such screw; r is a piece of soft rubber, or equivalent substance, placed between the prongs of the spring c^3; c^7 is a wire or band which serves to bind the prongs tightly against the rubber r, so as to prevent the prongs acting as a tuning fork, and transmitting harmonic vibrations not desirable; r^2 is the plumbago contact point. The object of the U spring and rubber is to present a semi-rigid point for contact, so as to prevent a rebound, and allow of a slight yield when the plumbago is pressed by the diaphragm.

In Fig. 3 the diaphragm of the receiving instrument is vibrated by a strip of paper chemically prepared that is in motion, the pulsations of electricity passing over the line and producing more or less friction between the paper and an arm upon the diaphragm.

The resonant box or chamber n is provided with a diaphragm as aforesaid, and to said diaphragm an arm h^2 is connected; at its outer end is an adjusting screw h^3, that presses upon a platina-faced spring h^4 that is secured to this arm, and said spring rests upon the strip of paper that passes over the drum h^5.

The paper is moved slowly by rotating the drum h^5, and the waves of electricity coming over the line pass through the arm h^2 to the platina-faced spring h^4, thence through the paper to the earth.

If a negative current passes in the opposite direction, nearly all friction between

the platina plate and the paper ceases, and the diaphragm of the resonant box *n* regains its normal position.

When the positive current passes through the same channel, the normal friction of the paper is augmented, and the chemical surface acting upon the platina spring arm serves to give a forward movement to the diaphragm of the resonant box.

Thus the mechanical force applied to move the chemical paper or surface acts with the electric current to produce the vibration of the diaphragm of the resonant chamber, and these vibrations will correspond to those of the diaphragm *b*, made by speaking in the tube *a*.

The principle of this method of obtaining motion by electro-chemical decomposition is, that when a moving surface is in contact with a slightly yielding substance, the tendency is to move the latter by and with the former. If the circumstances of contact are varied, the adhesion of the surfaces will be sufficient to cause the moving surface to move the yielding substance, or else to cause the yielding surface to slip more freely, and by its spring go in the opposite direction to the moving surface.

The passage of electricity at the surfaces in contact will change the frictional adhesion, making it more or less, according to the substances employed. By balancing the mechanical forces, so that when the surfaces in contact are not electrified, the moving surface carries with it the yielding surface; and, when electrified, the yielding surface slips back over the moving surface, a mechanical movement is obtained that is dependent on the electrical condition of the surfaces in contact.

When it is requisite to obtain very perfect articulation, and when loudness is not essential, I adopt a modification, shown in Fig. 12, of the device for compressing and expanding the tuft of conducting fiber, which modification consists in placing between the diaphragm 10 and the fiber *t* a vibrating tongue 21 of steel, permanently magnetized, and arranging it to act in the same manner upon the tension regulator *t* as if it was the diaphragm. I replace the cork upon the diaphragm by a thin armature of iron 22 which is in close proximity to the magnetized tongue, which tongue is secured at one end like an acoustic reed. In this position the diaphragm is free to move, and at its approach to and recession from the magnetized tongue causes said tongue to follow its movements by magnetic attraction, and thus the tongue is made to perform what the diaphragm previously performed in varying the tension of the electricity on the line.

A modification of the magnetic receiving instrument consists in an iron plate fitted into the aperture of a resonant tube, and secured by a central support, leaving its outer circumference free to vibrate when the metal is attracted by the poles of the electro-magnet, which are of course on each side of its center; but it is preferable to place the support slightly out of center, as some portions of the plate will then be in tone for every sound.

A plate supported eccentrically and free at its edges when placed in the speaking tube responds advantageously to the tones of the voice; the circuit with this plate is completed through one or more tension regulators placed around its edges.

I have discovered that vulcanite or hard rubber produces cold and heat waves on its surface by the slightest movement, and in some cases I employ the same for the diaphragm of the resonant case *h*, Fig. 13, and place a thermo-electric pile *h*^{1} in very close proximity to the rubber, so that the vibration of the diaphragm 10 producing changes of temperature will cause currents of electricity to be set up within the thermo battery, and these passing over the line *l* and acting upon a very delicate electro-magnet and diaphragm will reproduce the sounds acting upon the rubber diaphragm.

In practice I combine with the speaking or telephonic apparatus signal bells, so arranged that when the telephone is not in use the line is thrown upon the bell by a switch, which also acts as a call on the bell.

One feature about the bells is that the magnet which serves to actuate the bells

is made of very high resistance, using preferably German silver wire in the helix, and thus serve to prevent a rapid consumption of battery power. A large number of telephonic wires may be worked from one battery if these bells are used.

The method I adopt for coating non-conducting substance with metallic substance is the reduction to the metallic state of metals from their salts by exposing them to the fumes which arise from the moist phosphide of a metal, such as phosphide of calcium, or by placing the silk, for instance, in a sealed tube provided with metallic electrodes, and volatilizing the electrodes by the passage of electric sparks; such volatilized metals settle upon and coat the silk.

When great loudness is desirable, as in factories, the tympan of the receiving instrument may be made to control an air valve of a reservoir in which air is stored under a regulated pressure.

The air allowed to escape will act with great power upon a local diaphragm. This diaphragm, to obtain clear sounds, requires a damper to check prolonged vibrations. It must be dampened by holding the fingers against it, or by a tightly-stretched cord rubbing against it, or by a screw provided with a rubber tip held against it.

For repeating from one circuit into another I use with the receiving diaphragm the elastic tension regulator Fig. 1 in addition to the electro-magnet, and connect the relay or second circuit through the same, so that waves received from the distant station cause the magnet to vibrate the diaphragm, and this acting upon the tension regulator transmits the waves into the second circuit, and they are received at the other end by an electro-magnet and diaphragm.

In some instances I make a record of the sound by the movements of the diaphragm, using for that purpose a strip of paper moved along regularly between two rollers 25, 26, as in Figs. 14 and 15; and there is a smooth thread or fine wire of soft metal 30 between the paper and the upper roller 25, and moving along with it. The diaphragm 10 of the resonant box is connected by a delicate rod 28 with this thread or wire as near to the bight of the roller as possible, there being a fork or eye through which the thread passes, hence deflections or bends are made in the thread or wire just before it is imbedded into the paper by the pressure of the rollers; this may be used to reproduce the sound by vibrating a resonant diaphragm by the undulations of the groove made by the thread or cord.

By placing the fibrous tension regulator within a small band of india-rubber the same is rendered more elastic, and the fiber is allowed to expand by the heat of the current without altering the electric tension.

In cases where a strip of hard rubber or a cord of silk or other material coated with plumbago or metallic foil is introduced between the diaphragm and a rigid support, the expansion and contraction due to the passage of the electric currents will produce a movement upon the diaphragm corresponding to the diaphragm producing the electric pulsations.

In some instances the diaphragm should be free to vibrate without being checked by contact with any stationary substance. I provide for this by placing upon the diaphragm or tympan 10, Fig. 17, a small cylinder t^7 of hard rubber or non-conducting material, within which is the fibrous tension regulator t resting upon a piece of platina foil connected to one pole of the battery, and within this cylinder t^7 is a disk t^{10} of iron or other metal, loose, but pressed towards the tension regulator by a spring t^8 and screw cap t^9, and the other electric conductor is connected with said spring.

The inertia of the metal disk causes more or less compression of the tension regulator as the diaphragm is vibrated, and hence the electric pulsations are sent over the line in harmony with the vibrations. Nearly the same effect is produced by connecting the disk t^{10} to a yielding spring t^{11} that extends across from one edge of the diaphragm to the other, as seen in Fig. 16. This construction of tension regulating device is especially available with large diaphragms.

In some cases I use a soft rubber diaphragm immediately in contact with the

transmitting or receiving diaphragm, so as to check or dampen any prolonged or false vibration, and render the sound more clear and free from prolonged tones.

In preparing the tension regulator I find in some cases that it is preferable to use lampblack mixed with pure plumbago, amorphous phosphorous, and a very small amount of non-conducting material, such as rubber dissolved in a solvent that will entirely evaporate.

In Fig. 19, I have represented the circuit as passing through the diaphragm 10, tension regulator *t*, and a Dulues dry pile battery D, P, B, to the earth. This battery is composed of about 300 pairs of paper disks coated with silver and black oxyd of manganese.

Fig. 20 illustrates the device before mentioned for intensifying the sound; 10 is the diaphragm vibrated by the sound; 42 is a valve moved by such diaphragm; 43, is a reservoir containing air under a given pressure; *b* is the diaphragm against which the air, allowed to escape by the valve, acts, and *t* is the tension regulator to transmit the electric pulsations, or a hearing resonant case may be applied at the same place.

Many curious and useful features have been developed by my extended researches in the transmission and reproduction of sound. Among these may be mentioned the fact that a copper diaphragm, or a diaphragm of mica or other flexible material containing copper, will act with the core of a polarized electro-magnet in transmitting or receiving.

If a diaphragm with a metallic button upon it is so close to the core of a permanent magnet, see Fig. 21, that the vibrations of the diaphragm by sound cause such button to strike the core, a corresponding electric pulsation will be set up in a helix around the magnet, and the same will act in an electro-magnet at the distant instrument by molecular disturbance.

If the diaphragm 10 has a thin tube attached to the center, as seen in Fig. 22, and this project into the helix around one pole of magnet 48, the current set up in that helix by the vibration of the diaphragm and tube will be much greater than that resulting from a flat armature on the diaphragm or the diaphragm itself.

The magnet 48 may be polarized by a helix and a local circuit and battery.

If one pole of the permanent magnet m^5, Fig. 23, is connected with the plate *c* so that the latter is polarized by induction, the current set up in the helix around one pole of the said magnet is intensified. In this case I groove the end of the helix pole, and insert a small piece of soft rubber or tubing that serves to dampen the vibrations of the diaphragm, and prevent false or harmonic vibrations in speaking.

Fig. 24 represents the diaphragm 10, tension regulator *t* with its adjusting screw and local circuit containing the battery B, passing through a primary induction coil 49, and there is a key 50 in the same circuit. A secondary induction coil 51 is in the line circuit, and is influenced electrically by the change of tension in the local circuit by the vibrations of the diaphragm 10.

The secondary coil is sometimes required with many layers of fine wire to set up a current of high tension to overcome the inductive effect from the line wires, being adjacent to each other. I place the receiving instrument at the distant station between the induction coil and the earth as at R, and use an electro-magnet E, M, with polarized armature to strike a bell; this will respond when the key 50 in the local circuit at the distant station is opened and closed.

In Fig. 25 a similar induction coil 49 and local circuit is represented, but the tension regulator is made of platina foil upon the surface of two soft rubber tubes, one on the diaphragm, the other on the adjusting screw. A shunt and rheostat at R^1 serves to prolong the magnetism in the induction coil, and thus ensure a gradual rise and fall of electric tension in the line instead of a cessation of the same when the platina surfaces separate, and at the receiving diaphragm *c*, the rise and fall of electric tension in the line and its helix acts upon the permanent magnet to produce the vibrations of the diaphragm *c*, and by connecting a shunt around

the helix, and placing therein the secondary battery S, B, composed of metallic plates in acidulated water, the action is rendered more uniform and the sound distinct.

When the diaphragm is arranged as in Fig. 26 to act upon a spring 56, through an intervening piece of soft rubber, said spring 56 produces rise and fall of electric tension by employing a range of resistances 57 with spring tongues adjacent to 56. The greater amplitude of vibration of the diaphragm the more direct will be the electric circuit connections and the less resistance, because the circuit will pass along the spring instead of going through all the resistance coils.

When there is an electro-phorous or resinous disk 58, immediately facing each diaphragm 10, as in Fig. 27, and the line connections are made to the diaphragm, and the earth connections are made to these electro-phorous disks 58, the diaphragms will respond to each other in either speaking or hearing.

Where several line wires run near each other, the wire used for the acoustic or speaking telegraph is influenced by induction, and false sounds will be produced. I counteract this tendency by placing one or more electro-magnets 59, Fig. 28, in the circuit of the speaking telegraph, and one or more electro-magnets 60 in the circuit of the adjacent wires, and bringing the opposite cores of 60 at such a distance from the cores of 59 that a certain magnetic action will be set up in 59, by induction in the opposite direction to the induction currents from the adjacent line or lines.

By adjusting the distance between these magnets when the speaking telegraph is not in use, until there is not any sound at the diaphragm from the induction currents, then these currents will be neutralized, whether strong or weak, and will not produce any false sounds when the speaking telegraph is in use.

I also employ double coils of wire for the same purpose, one coil being in the acoustic wire, and the other in the wire to be compensated.

A convenient form for the sound recorder or phonograph is to employ a cylinder 61, see Fig. 29, having a helical groove in its surface covered with tin foil, and the cylinder is revolved regularly by clockwork and moved endwise by a screw on its shaft, so that the indenting point l^1 from the diaphragm 10 of h will be always in line with such groove, hence the vibrations of the diaphragm will be recorded by indenting the foil into the groove, and hence the same sound will be reproduced by the point l^2 of the hearing instrument n, giving to the diaphragm of n the motions that result from the indentations of the foil moving in contact with such point.

The foil may be on a flat grooved plate and be indented and act as before-named.

I claim as my Invention,—

First. In an instrument for transmitting electric impulses by sound, a diaphragm or tympan of mica, substantially as set forth.

Second. In an instrument for transmitting electric impulses by sound, the combination with a diaphragm or tympan of an electric tension regulator for varying the resistance in a closed circuit, substantially as set forth.

Third. The combination in an electric instrument actuated by sound, of a diaphragm or tympan, a conductor, and an electric tension regulator composed of yielding material and electric conducting material.

Fourth. The combination with the diaphragm and electric conductor, of the cork disk and tension regulator, substantially as set forth.

Fifth. In a telegraph operated by sound, the transmission and reproduction of the human voice by increasing and descreasing the resistance of the circuit, substantially as set forth.

Sixth. The combination with a diaphragm or tympan, of electrolytic fluid and electrodes, the latter being vibrated by the diaphragm and varying the resistance in the electric circuit, substantially as set forth.

Seventh. In an instrument for transmitting sounds by electricity, a resonant case having an opening or edge, against which the consonant sounds act, substantially as set forth.

Eighth. In combination with the diaphragm or tympan and the electric tension regulator, the adjusting screw or variable presser to regulate the resistance of the tension regulator in the electric circuit, substantially as set forth.

Ninth. The combination with a diaphragm in a speaking telegraph instrument of a moving surface, and a recording mechanism actuated by the diaphragm or tympan, substantially as set forth.

Tenth. The combination with a receiving diaphragm or tympan in a telegraph operated by sound, of a moving surface, a point, and a connection from the same to the diaphragm, substantially as set forth.

Eleventh. The combination in an instrument for receiving sounds electrically, of an electro-magnet and armature plate, substantially as set forth.

Twelfth. The combination in the telegraphic circuit of two or more tympans, a resonant box, and one or more circuit closers to each tympan, substantially as set forth.

Thirteenth. The combination with the diaphragm of a resonant case, of circuit connections at both sides of the diaphragm and a battery, substantially as shown in Fig. 10.

Fourteenth. In a telegraph instrument operated by sound, a resonant box or case, a diaphragm and flexible circuit connections, substantially as set forth, whereby the instrument is made portable and can be placed to the mouth in speaking.

Fifteenth. In a telegraphic instrument operated by sound, an electro-magnet and resonant plate or diaphragm provided with a handle and flexible conductors, substantially as set forth.

Sixteenth. The receiving instrument consisting of an electro-magnet, a case, and a loose metallic plate, arranged and operated substantially as set forth, to act as a call or to receive the message.

Seventeenth. In a telegraphic apparatus operated by sound, one or more contact points of yielding material that produce a rise and fall of tension proportioned to the pressure exerted by the diaphragm, substantially as set forth.

Eighteenth. In a telegraphic apparatus operated by sound, a receiving instrument provided with a resonant surface, in combination with a frictional surface moved by power and acting in connection with the electric current to vibrate such resonant receiver, and produce tones corresponding to those at the transmitting apparatus, substantially as set forth,

Nineteenth. The combination with a thermo-electric pile of a vulcanite or hard rubber diaphragm, substantially as set forth.

Twentieth. The method herein specified of recording the undulations of the diaphragm or yielding material, and the reproduction of sound by such material acting upon a diaphragm to communicate to the same vibrations similar to the original ones, substantially as set forth.

Twenty-first. The combination with the diaphragm and tension regulator, of a magnetized tongue and an iron plate upon the diaphragm, as set forth and shown in Fig. 12.

Twenty-second. In combination with the diaphragm operated by sound, an electro-magnet, a valve, and a chamber of compressed air or gases to reproduce the sounds in louder tones.

Twenty-third. The method herein specified of preparing fiber for electric tension regulators by conducting or semi-conducting material associated intimately with such fiber, substantially as set forth.

Twenty-fourth. In an instrument for receiving sound telegraphically, a plate, loose at its edges, and supported upon a post or standard, substantially as set forth.

Twenty-fifth. The combination with the sending and receiving diaphragm of the dry pile illustrated in Fig. 19.

Twenty-sixth. The combination in a telephonic instrument, of an iron diaphragm

and a magnet, one end of which is attached to the magnet, substantially as specified.

Twenty-seventh. The combination with the electric circuit and a diaphragm of an induction coil and magnet, substantially as set forth.

Twenty-eighth. The combination with the induction coil, diaphragm, and local circuit of a key in said circuit, and a call or sounder at the distant station, substantially as set forth.

Twenty-ninth. The combination with a diaphragm of rheostats or resistances in the line or local circuit, and means for short circuiting such resistances in proportion to the movement of the diaphragm, substantially as set forth.

Thirtieth. In combination with an electric circuit containing instruments for reproducing sound, one or more electro-magnets and one or more compensating magnets for neutralizing the inductive effect of adjacent telegraph wires, substantially as set forth.

In witness whereof, I, the said Thomas Alva Edison, have hereunto set my hand and seal, this Twenty-fourth day of December, A.D. 1877.

THOMAS ALVA EDISON. (L.S.)

Witnesses,

CHAS. H. SMITH, 76, Chambers St., New York.

WILLIAM G. MOTT, " " "

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

1878.

A. D. 1877. July 30. N° 2909.
EDISON'S Specification.

FIG. 1.

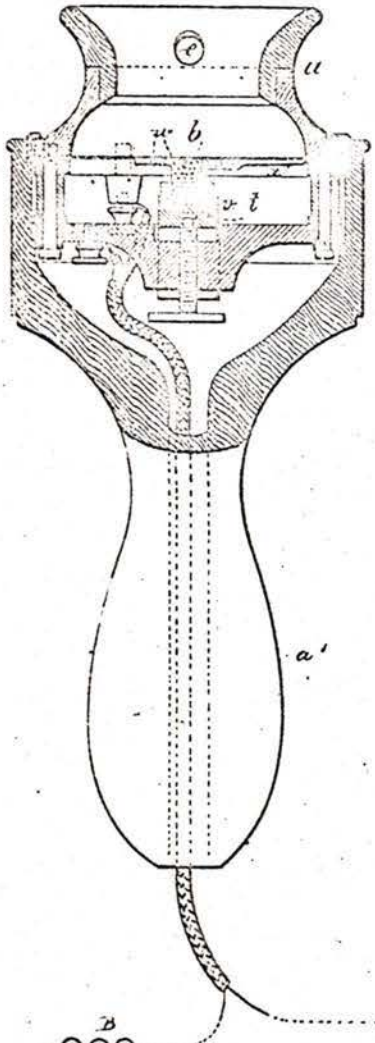
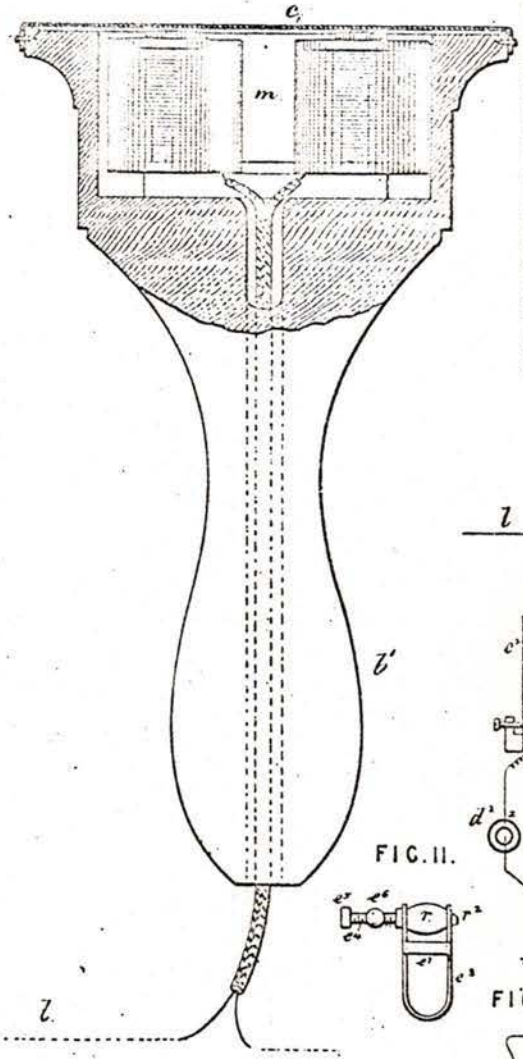


FIG. 2.



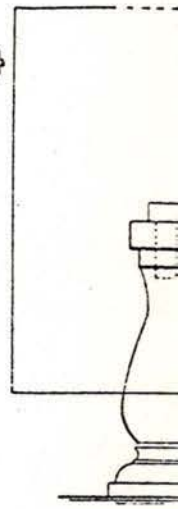


FIG. 10.

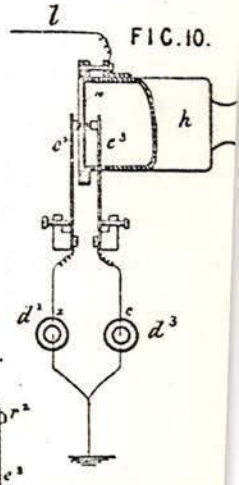


FIG. 11.

FIG. 12.

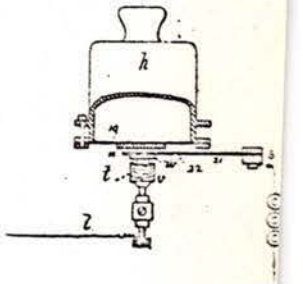


FIG. 14.

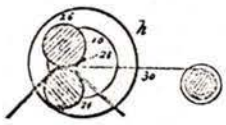


FIG. 15.

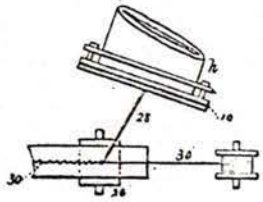


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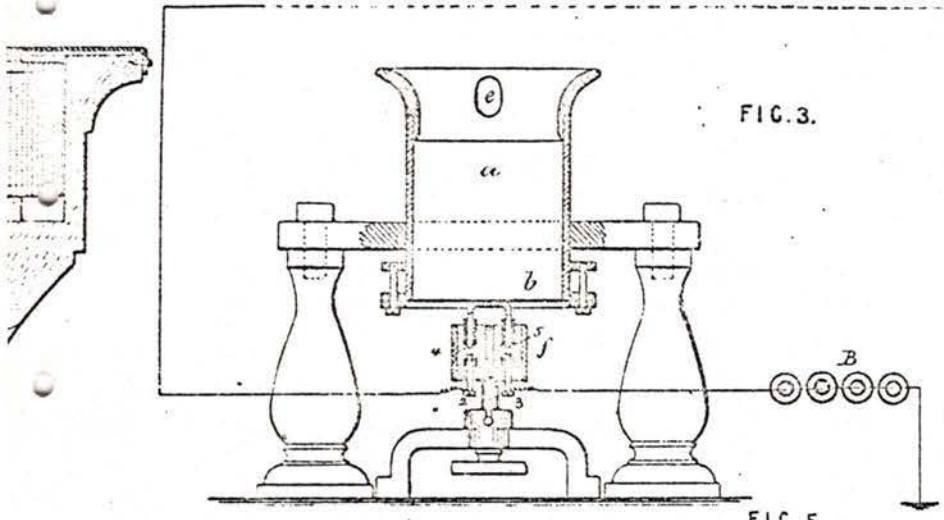
FIG. 3.



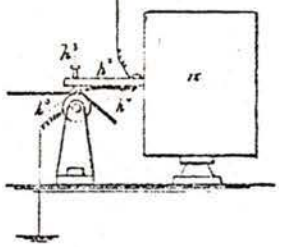


FIG. 4.

FIG. 5.

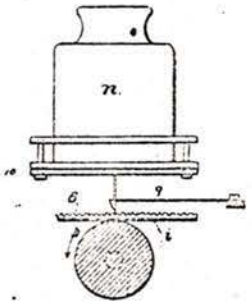


FIG. 7.

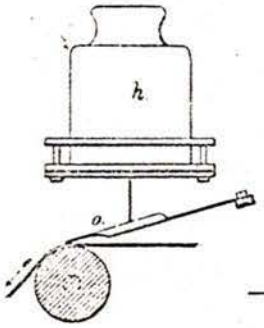


FIG. 10.

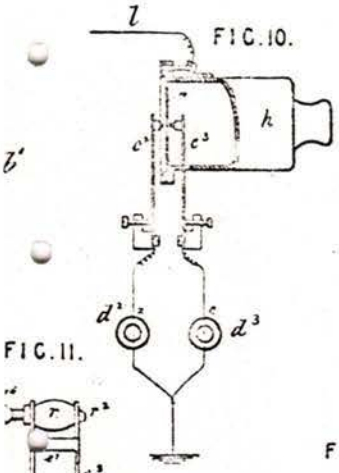


FIG. 11.

FIG. 12.

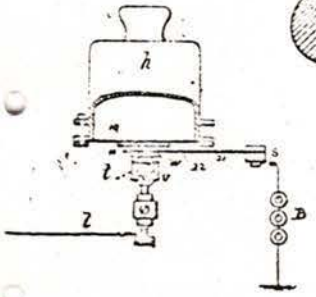


FIG. 8.

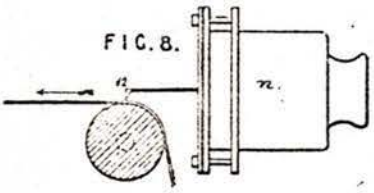


FIG. 13.

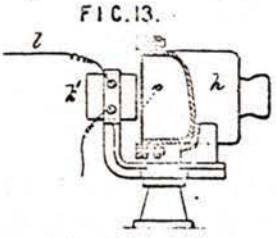


FIG. 6.

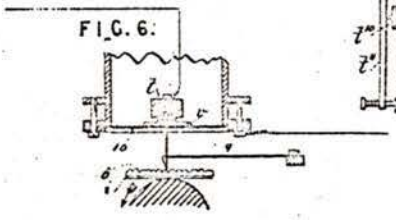
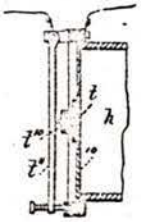


FIG. 16.



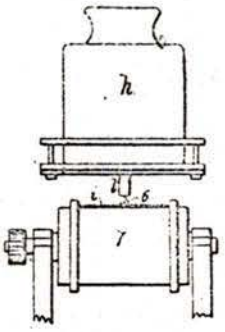


FIG. 17.

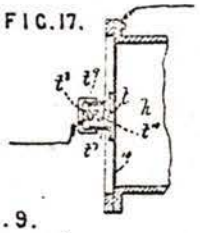
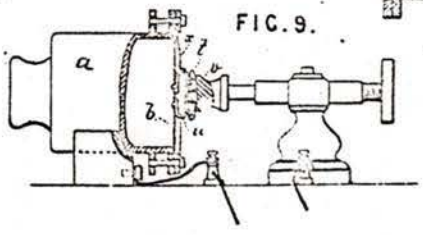


FIG. 9.



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EDISON'S Specification.

FIG. 24.

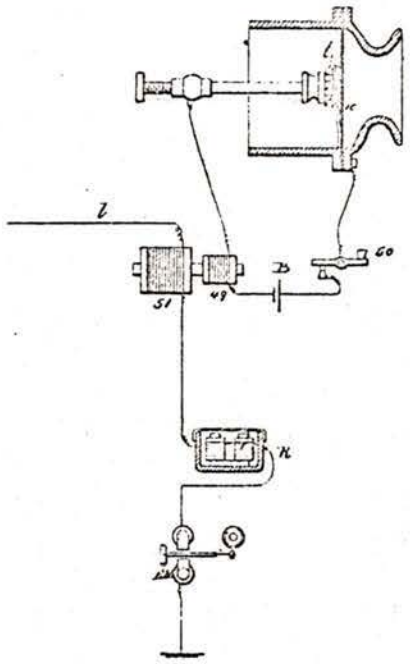


FIG. 18.

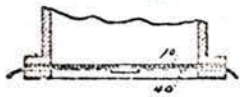
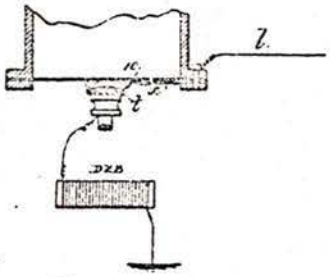


FIG. 19.



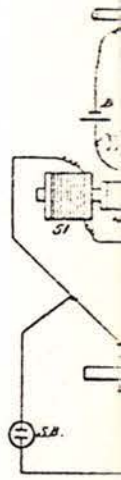


FIG. 20.

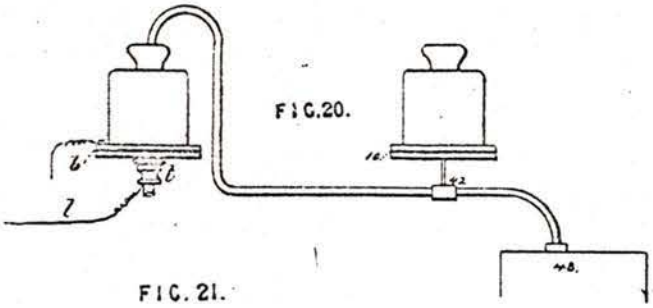


FIG. 21.

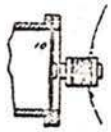


FIG. 23.

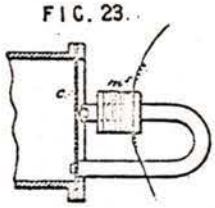
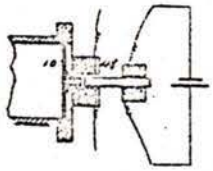
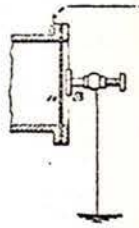


FIG. 22.





The filed drawing is not colored.

London. Printed by George Edward Eyre and William S
Printers to the Queen's most Excellent Majesty

FIG. 24.

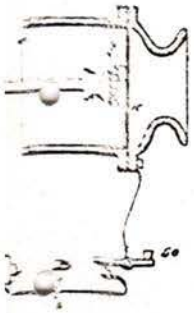


FIG. 25.

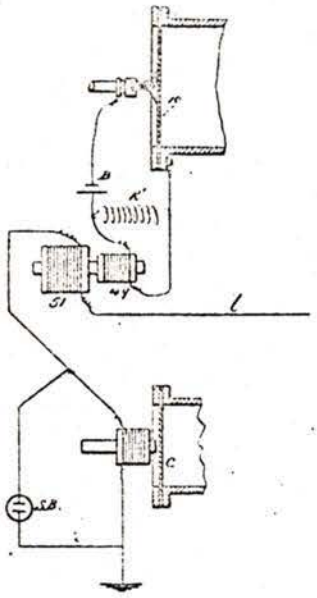


FIG. 28.

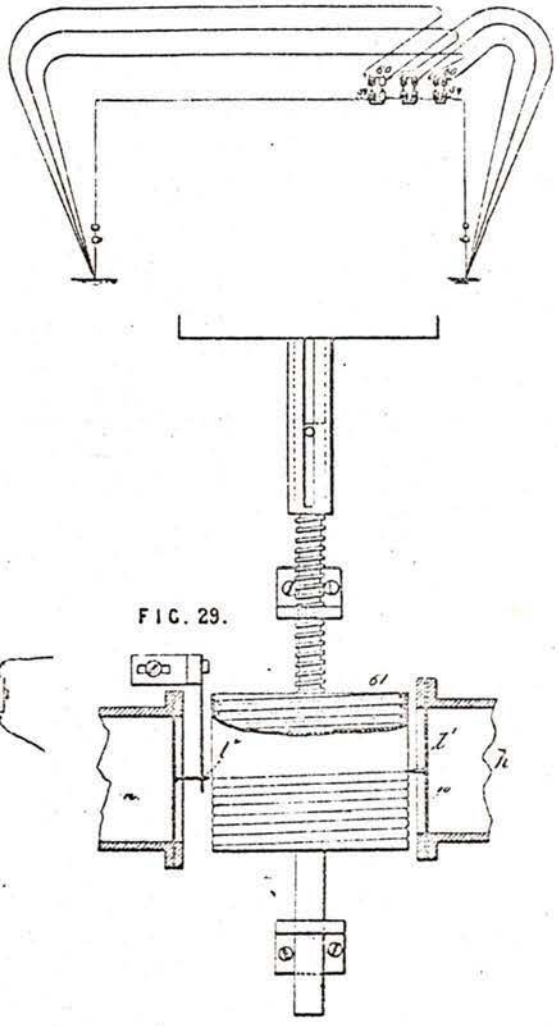


FIG. 26.

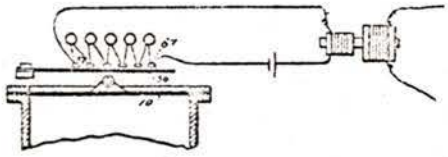
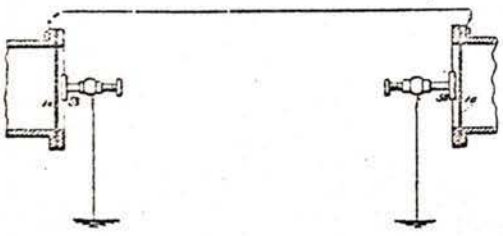


FIG. 29.

FIG. 27.



LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1877.

A.D. 1878, *24th April.* N° 1644.

SPECIFICATION

OF

THOMAS ALVA EDISON.

RECORDING AND REPRODUCING SOUNDS.

PRINTED BY ORDER OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS.

LONDON:
PUBLISHED AND SOLD AT
THE COMMISSIONERS OF PATENTS' SALE DEPARTMENT,
28, CURSITOR STREET, CHANCERY LANE, E.C.

Price 10*d.* 1878

A.D. 1878, *24th April.* N° 1644.

Recording and Reproducing Sounds.

LETTERS PATENT to Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, for the Invention of "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

Sealed the 6th August 1878, and dated the 24th April 1878.

PROVISIONAL SPECIFICATION left by the said Thomas Alva Edison at the Office of the Commissioners of Patents on the 24th April 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

My present improvements are for more fully developing and perfecting the device heretofore invented by me, and known as the "phonograph."

By extensive experiment and research I have been enabled to obtain very perfect articulation and to produce a record in a convenient form for preservation.

The sound vibrations are made to move a point that by preference is a diamond or other very hard substance and of a peculiar shape. The sound vibrations in the atmosphere act upon a diaphragm or other body capable of motion, and the same moves the indenting point, and acts as a phonograph. The indented material is properly designated a phonogram, and it is preferably metallic. Sometimes tin-foil is used upon a grooved surface; sometimes a thin sheet or leaf of metal is placed upon a piece of paper having a surface of parafin or similar material.

Sometimes the metallic surface is copper, and where a matrix has been made of steel or iron by electrotype deposit, or otherwise, upon the phonogram it may be hardened and used for impressing a sheet or roller of metal, and thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence, or words, or sounds phonetically.

[*Price* 10*d.*]

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet."

In order to facilitate production, use, and preservation of the phonograms I employ a ring or margin of thick paper or pasteboard, caused to adhere to the foil or sheet by resinous substance; this is used as a gauge in placing the sheet in the instrument or replacing the same in the phonet. I find that a disc revolved by gearing, and a weight or spring, and the movement regulated by a fan or governor, is a convenient device for presenting the surface to be indented to the phonograph, and the phonograph is on an arm that swings towards and from the centre of the disc, and is guided by grooves or other convenient mechanism.

The phonet device takes the place of the phonograph device when the sounds are to be reproduced.

When the sheet of material is wrapped around a cylinder its edges are passed down into a slit and held firmly. Either the cylinder may be moved endwise by a screw, or the phonograph or phonet devices be moved along the cylinder, and where the same sound is to be reproduced periodically, as calling out the hours of the day in a clock, or reproducing the sounds of animals in toys, the phonet is to be brought to the place of beginning automatically.

The phonographic devices employed by me are preferably a diaphragm of metal, against which the sound vibrations act. Sections of rubber tube applied to the surface act as dampers to prevent false vibrations; pieces of felt or similar yielding material may be used for the same purpose, and a small delicate hoop of spring metal between the diaphragm and the indenting point renders the phonogram more perfect than it would be if the diaphragm acted upon the point direct. A similar effect is produced by a disc upon the arm that carries the point, said disc being so close to the diaphragm that the atmosphere will produce the vibrations.

It is often advantageous to use a case between the mouth of the speaker and the diaphragm to gather or hold the sound, and in some instances the head of the speaker should be inserted into this case, up through a hole in the bottom. The mouth-piece is sometimes slotted or perforated, and has irregular edges to re-inforce the hissing sounds, and sometimes a membrane of rubber or gutta percha is fitted to the teeth, and forms a bag between the lips and the diaphragm.

The disc upon the arm that carries the point as aforesaid may be acted upon by a magnet, and the current through a helix from a diaphragm, or the motion of the arm and points may serve to set up a secondary current through such helix in consequence of the motion given by the phonogram to the point. The arm carrying the point in this latter case should be magnetised.

The phonogram may be produced by the direct action of air concentrated to the spot by a funnel terminating with a small hole, the end of the funnel being almost in contact with the moving surface to be indented.

When the foil is perforated instead of indented it can be rolled up in the form of a horn or cylinder, and revolved, and the articulation result from air blown from the end of a small tube passing through the perforations as they are presented in succession.

Leverage is sometimes employed between the diaphragm and the phonogram, either to lessen or increase the motion of the phonographic action in recording, or of the phonetic action in speaking, and for recording quartette, trio, and other characters of singing, two, three, four, or more phonographic devices are employed upon one cylinder or plate, and the sounds will be reproduced by corresponding phonets; or where singing is conveyed through tubes to one diaphragm the phonographic record will be the combined tones, and the reproduction by the phonet will be complete and correct.

I find that an arm at right angles to a diaphragm, with a point resting upon the phonogram, will reproduce the tones by the weight and leverage of the arm moving the diaphragm.

The phonogram may be in the form of a disc, a sheet, an endless belt, a cylinder, a roller, or a belt, or strip, and the marks are to be either in straight lines, spiral,

zig-zag, or in any other convenient form, so long as the apparatus is adapted to bringing the same into contact with the phonet or speaking part of the apparatus, and the reproduction of the phonogram from a matrix or copy in relief of an original phonogram may be made upon a belt, roller, cylinder, plate, or other convenient surface.

For amusement and instruction this phonograph is capable of extended use. For instance, a revolving cylinder containing phonograms of the letters of the alphabet and phonet keys, with corresponding letters on them, can be used in teaching the alphabet; and phonogram sentences, speeches, and other matters can be spoken by the phonet and repeated by the learner without the eyesight being called into use.

For amusement or instruction the phonogram can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, a lion's roar, and the like, and the phonogram can be used in a toy animal with a single phonet for the reproduction of the original sound.

This phonograph or speaking machine applied to a mask produces a semblance of vitality if the phonogram is made to operate upon moveable lips by levers, and in the production of such a phonogram a portion of the surface is to be indented by delicate levers and points, receiving motion from the lips during articulation; thereby a correct reproduction of the motion of the lips is obtained.

In connection with the phonet it is important to avoid the sound that usually results from the rubbing action of the phonogram upon the point. I am enabled to prevent this by an electric action between the point and the phonogram. In this case the phonogram should be of iron, and the point of steel and the parts magnetised so as to slightly repel each other; the point will follow the undulations and reproduce the sounds by the phonet.

It is important that the point used in the phonet correspond in shape to that of the phonograph, but slightly smaller, so as to follow the bottom of the depressions without contact upon the sides.

The diaphragm or other body employed in the phonet to receive motion from the phonogram is connected with a funnel of paper or other resonant substance that acts as a sounding board to render the phonet louder and more distinct.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Thomas Alva Edison in the Great Seal Patent Office on the 22nd October 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

This Invention consists in means for recording in permanent characters th sounds made by the human voice in speaking and singing, those made by musical instruments, birds, animals, or any sound whatever, and in means for reproducing those sounds at any desired time.

The sound vibrations act upon a diaphragm or other body capable of motion; this diaphragm is at the back of a chamber provided with an opening or mouth-piece, and to this diaphragm an indenting point is secured. This instrument I term a "phonograph." The phonograph is adjusted to position with its indenting point contiguous to a mo ing surface covered with a thin sheet of metal foil or other suitable material, or else the surface with the metal foil is stationary, and the phonograph movable.

The surface upon which the metal foil is secured is by preference grooved spirally, and this indenting point indents the foil in the line of this groove as the diaphragm is moved back and forth by the sound vibrations; these indentations are a record of the sound waves, and form the characters for reproducing the sounds. This indented sheet I term a "phonogram."

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet." It is similar in construction to the phonograph, being provided with a diaphragm and point, but the mouth-piece is by preference funnel-shaped to render the sound loud and distinct. The sounds are reproduced by the phonet being adjusted to place so that the point of its diaphragm is at the beginning of the spiral line of indentations, and as the surface containing the indented foil is moved the diaphragm of the phonet is vibrated by the point passing from one indentation to the next, hence the diaphragm receives the same movement from the indentations as when making those indentations, consequently the sounds made by the phonet will be the same as those that operated upon the diaphragm of the phonograph.

In the Drawing Fig. 1 is a section of the phonograph and sectional elevation of the mechanism for presenting the surface to be indented; and Fig. 2 is a plan of the same.

The phonograph is made of the body portion *a*, diaphragm *b*, and indenting point *c*. The body portion *a* has a central opening forming the mouth-piece into which the person speaks, or through which opening the sound vibrations pass to act upon the diaphragm, and the diaphragm is secured at its edges to the body *a*, leaving a space between the body and diaphragm in order that the diaphragm may vibrate freely. The indenting point should be a diamond or other very hard substance.

The diaphragm is made of a thin sheet of iron or other material and it is preferable to place the indenting point upon a delicate spring arm c^2, and to employ a short piece of rubber tubing c^3 between the spring and diaphragm: this rubber acts as a damper to prevent false vibrations of the diaphragm.

The phonograph is upon a lever arm *i* pivoted at 5 to the vertical stud 6, so that the phonograph may be raised or lowered vertically, or moved horizontally for a purpose hereafter explained.

It is now to be understood that if a person speaks with his mouth near the mouth-piece of the phonograph the sound vibrations will act upon the diaphragm, and vibrate it, and communicate to the indenting point a similar movement, and that if a piece of metal foil or other material susceptible of being indented is placed

beneath or behind the indenting point and caused to move regularly, or the indenting point moved over the material; that said material will be indented and form a perfect record of the sound vibrations.

I will now describe the means for sustaining the sheet to be indented, and the mechanism for moving the same:—*d* is a disk or plate secured to and turning with the shaft *c*, and hinged to this disk is a ring frame *f*; this disk *d* has two spiral grooves 3, 4, in its surface. There are pins 2, 2, upon the surface of the disk, and holes at corresponding places in the ring frame; the sheet to be indented is of a size and shape to correspond with that of the disk *d* and frame *f*, and said sheet has holes in it corresponding to the position of the pins 2, 2, and these holes form register marks in placing or replacing the sheet upon the disk *d*, and after the sheet is so placed the ring frame *f* is brought down upon the sheet and holds it firmly in place. There may be a central opening in the indented sheet of a size slightly larger than the space occupied by the spiral 3, and the outer edges of the sheet are stiffened by a ring of thick paper or pasteboard caused to adhere by glue or other adhesive material. The surface of the disk *d* is made with two spiral grooves 3 and 4 as aforesaid; the groove 3 is a guide for a pin that is upon an arm *g* on the phonograph, and the groove 4 is for the indenting point *e*. As the disk and sheet are revolved the groove 3 causes the indenting point to occupy a position immediately over the line of the spiral 4, and the indentations will be made upon the sheet of foil in a line corresponding to that of the spiral 4, shown in Fig. 2. The indentations made in the foil are a complete record of the sound vibrations that acted upon the diaphragm *b*, and from this indented sheet, which I term a "phonogram," the sounds are reproduced. The phonograph is carried outwardly by the spiral 3, and in so doing the parts swing upon the vertical stud G. By depressing the outer end of the lever *i* the phonograph is raised so that it can be swung aside from the disk *d* to allow of the ring frame *f* being thrown back and the indented sheet or "phonogram" removed from the disk.

The shaft *c* is revolved by a weight, or spring, and gearing at *k*, and the spring is wound up by moving the lever *k* back and forth, which acts upon a ratchet and pawl of ordinary construction; *l* is a lever provided at its outer end with an inclined groove, in which is a pin on the lever *m*, and the other end of this lever *m* is connected with the coupler m^1 by moving the lever *l* one way or the other, the shaft *c* will be connected to or disconnected from the gearing *k*, and hence the disk *d* stopped or started at pleasure without interfering with the motor.

As it is necessary that the shaft *c* should be revolved with uniformity I provide a governor at *n* to prevent the apparatus revolving too rapidly; and this may be made as in Figs. 1, 3, & 4, in which there are metal blocks *o* at the ends of spring arms from a cross head on a shaft that is driven by the gearing *k*, said blocks swinging radially and acting against the interior of a stationary cylinder *p* if the speed becomes too great, thereby checking the speed by the friction of the blocks against the cylinder. These spring arms may be secured at one end to a prismatic block as shown in Fig. 5. It is preferable to cover the surface of the blocks *o* next the cylinder *p* with felt or similar material that will slide upon the interior surface of the cylinder *p*, but produce more or less friction, according to the centrifugal action.

The guide spiral 3 may be dispensed with, and either of the devices shown in Figs. 6, 7, 8, or 9, made use of,

In Figs. 6 and 7 the shaft *c* projects above the surface of the disk *d*, and there is a tooth upon the shaft contiguous to a rack bar extending from the phonograph, hence each revolution of the shaft, the rack bar, and phonograph will be moved the space of one tooth, consequently the lines of indentations will be parallel and concentric to the shaft *c*, excepting at the places when the tooth acts to move the rack bar and phonograph outward or inward. In this case the spiral grooves are cut to correspond to the feed.

In Fig. 8 a worm upon the shaft *c* acts upon a worm pinion to revolve the shaft c^6, and the worm at the other end of this shaft c^6 acts upon teeth around the base of

the lever i on the stud 6. By this device the phonograph will be moved outward gradually, and the line of indentations will be in a spiral corresponding to the continuous spiral groove in the plate d.

In Fig. 9 the shaft e is made with a fusee at p^1, and one end of a swinging arm connected to the phonograph takes against the same. The spirals of the fusee gradually move outward the phonograph, as the disk and shaft are revolved, and the line of indentations will be spirally the same as that made by the spiral 3.

In Fig. 10 the shaft e is provided with a screw pinion meshing with teeth upon a cam wheel 7. This gives the same movement to the phonograph as the spiral groove 3.

In Fig. 11 the guide-groove 3 for the arm and pin g is upon a disk d^1 upon the shaft e, but the groove 3 occupies the same relative position upon the disk d^1 as the groove 4 upon the disk d, so that the phonograph is moved outwardly by the groove of the disk d^1, swinging both the arms g and i upon the vertical pivot 6.

Instead of the sheet of metal foil being upon the disk d it may be wrapped upon a cylinder q, as in Fig. 12. In this case the cylinder is upon a shaft e^1 revolved by the gearing at h^1, and upon said shaft there is a right and left hand screw at k^1, and there is a corresponding double spiral groove in the surface of the cylinder q. The phonograph is secured to a sliding shaft l^1, and said shaft is moved endwise back and forth by the screw k^1 acting upon an arm m^2 that is secured to the said shaft l^1. As the phonograph is moved in one direction the line of indentations is made spirally in the foil on the cylinder q, and when the arm m^2 reaches the end of the screw it will be moved in the other direction by the reverse screw thread, and the phonograph will make a second spiral line of indentations that will cross the first spiral line. This feature is especially available for a phonet where the surface of the cylinder q is formed of an electrotype or other copy of the phonogram, so that the words or sounds may be reproduced automatically and at intervals if desired.

It is preferable to make use of a thin metal plate n^2, see Figs. 13 and 14, pivoted at one end and fitting within a longitudinal groove in the surface of the cylinder q for securing the edges of the metal foil and holding it securely upon said cylinder. The top of this plate n^2 is flush with the surface of the cylinder, and grooved to correspond with the groves in the cylinder, so as not to interfere with the indenting point. A wire may replace this device, such wire being secured by arms at each end of the cylinder, and raised and lowered in and out of the groove by a cam or otherwise. I find that an interruption of one-eighth of an inch space where there is no recording is not detected by the ear.

The apparatus shown in Figs. 13 and 14 is similar to that shown in Fig. 12, except that the phonograph is stationary and the cylinder moves horizontally, and the shaft e^1 is only provided with a screw thread in one direction, hence the cylinder will have to be moved back by hand to bring it to place if desired to reproduce the sounds from the phonogram, or to position the phonograph if a new sheet of foil is to be indented after the first one has been removed. This is readily accomplished by raising the arm o^1 and its tooth from the screw k^1, which leaves the shaft e^1 and cylinder free to be moved back and forth.

In Fig. 15 the phonograph is fitted to move horizontally instead of the cylinder q, as in Fig. 12, but the shaft e^1 is provided with a screw thread in one direction only, hence the phonograph has to be positioned by hand after the arm o^1 has been raised from the screw k^1.

In Figs. 12 and 15 the phonograph can swing upon the shaft l^1 to raise the indenting point from the cylinder q, and allow for the removal or insertion of a sheet of foil, and there is a stop at S for adjusting the position of the phonograph when brought down to indent the foil.

In Figs. 13 and 14 the phonograph is upon an arm pivoted at 9, so that it can be swung horizontally away from the cylinder q for purpose aforesaid, and the adjustable stop 8 is also provided.

Thus far I have described the "phonograph" or instrument upon which the

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sound vibrations act, and which instrument acts to indent the sheet of foil and produce the "phonogram" or record of such sound vibrations.

Mechanism has also been described for presenting the sheet of foil to be indented by the phonograph.

I will now describe how the sounds are reproduced from the phonogram.

If it is desired to reproduce the sounds from the phonogram in the same instrument in which the phonogram was produced it is only necessary that the indenting point c be made to traverse the line of indentations in the phonogram, and that a funnel-shaped mouth-piece, shown by dotted lines in Fig. 1, be added to the phonograph to aid in increasing the loudness and distinctness of the sound. The instrument in this form I term a "phonet."

In the instrument shown in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, 14, and 15, the phonet requires to be positioned by hand, as before explained, in order that the point c may be placed at the beginning of the spiral line of indentations. As the point c passes from one indentation to the next, either by the foil being moved beneath said point, as in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, and 14, or by the point moving over the foil, as in Figs. 12 and 15, the diaphragm b receives a movement corresponding to the depth of the indentations, and corresponding also with the same movement it received from the sound vibrations when making those indentations, hence air waves will be produced by the movement of the diaphragm that will make sounds by passing through the mouth-piece of the phonet that will be exactly the same as the sounds that acted upon the diaphragm of the phonograph.

The material upon which the record is made may be of metal foil, such as tin, iron, copper, lead, zinc, cadmium, or a foil made of composition of metals.

Paper or other materials may be used, the same being coated with parafine or other hydrocarbons, waxes, gums, or lacs, and the sheet so prepared may itself be indented, or the material, say paper, may be made to pass through a bath of hot parafine and thence between scrapers. Thin metal foil is now placed on the material, and the sheet passed through rollers, which give it a beautiful smooth surface. The indentation can now be made in the foil, and the parafine or similar material, and the indenting point, does not become clogged with the parafine in consequence of the intervening foil.

If the copper foil, or tin foil with copper surface is used, and a matrix of iron or steel made by electrotype deposit or otherwise upon the phonogram, such matrix may be hardened and used for impressing a sheet or roller of metal as hereafter mentioned; thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence or words or sounds phonetically.

I will now briefly describe some modifications in the construction and operation of the phonograph and phonet.

In Fig. 16 the indenting point c is upon a spring arm c^2, as in Figs. 1 and 2, but there are short sections of rubber tube c^3 at each side of the diaphragm b to dampen the diaphragm and prevent false vibrations.

In Fig. 17, the rubber of the diaphragm acts against the outer end of the arm c^2 to increase the leverage and lessen the depth of indentations in the foil and allow of the record being made in less yielding material than tin foil.

Fig. 18 shows a modification of the last-mentioned device, the pressure being applied to the arm c^2 between the indenting point and the support for the arm so as to increase the depth of the indentations.

Fig. 19 shows the arm c^2 made as a lever with a spring.

Fig. 20 shows the indenting point upon the center of a spring bar that is firmly held at each end; the bar is connected at its center to the diaphragm b by a string or otherwise.

Fig. 21 represents the diaphragm b as of concave form instead of flat.

Fig. 22 shows the indenting point upon a spring secured to the diaphragm.

Fig. 23 shows a disk upon the spring e^2 of the indenting point; this disk is placed quite close to the diaphragm and is moved by the air as the diaphragm is vibrated, the disk being so close to the diaphragm that the two will vibrate together, as air cannot pass between or escape as rapidly as the vibrations take place.

Fig. 24 shows the diaphragm vibrated by electro-magnetism; in this case the diaphragm is to be of iron, and the power of the electro-magnet will be varied by a rise and fall of electric current passing through the helix of the electro-magnet; this rise and fall of electric tension is to be produced by the action of sound upon a diaphragm and connections in an electric circuit.

Fig. 25 shows the method of vibrating the indenting spring and point by the direct action of an electro-magnet without the use of a diaphragm, the electric tension in the helix being varied by sound vibrations upon a diaghragm.

Fig. 26 shows the spring arm e^2 connected to one end of a permanent magnet so as to highly magnetize the reproducing point; the foil should be of iron. When the point passes an indentation there will be less attraction than when passing no indentation; this will give good articulation free from the scraping noise of the point on the foil, for in this case it does not touch the foil, but is worked by magnetic attraction.

Fig. 27 represents two instruments in connection with the cylinder q; in this case the phonet and the phonograph are separate. The phonograph records in the usual manner, but the phonet has its diaphragm set in motion by the rise and fall of the lever e^2. This reduces the scraping noise of the foil and acts by leverage, and a slight tension to move the diaphragm as the phonogram is moved beneath the point c.

Fig. 28 shows an arrangement whereby four persons may speak simultaneously and have records made in separate parallel lines upon one cylinder, and the phonogram will reproduce the sounds the same as though it contained the record of but one voice.

Fig. 29 shows a single phonograph adapted to receive the voices of three persons as in singing; the sounds made by the three voices are conveyed through flexible or other tubes to the diaphragm, and will be recorded in a single line of indentations, but when reproduced by the phonet the sounds uttered will correspond to the three voices.

In Fig. 30, the foil is sustained upon a hollow cylinder with a funnel-shaped end. The record is made upon the foil in the usual manner by the phonograph, excepting that holes are made entirely through the foil. A nozzle with a small opening is placed so that it will always be opposite the line of perforations as the cylinder is revolved. This nozzle is connected to a source of compressed air or other fluid, and every time a perforation comes opposite the nozzle, a puff of air passes into the cylinder and a sound is produced upon the principle of the siren. The nozzle may be placed on a spring to keep the end of the nozzle in contact with the line of perforations.

Fig. 31 shows the phonograph as made with a large chamber between the diaphragm and the mouth-piece; this is especially useful in collecting sound when the person speaking or the sound to be recorded is made several feet from the instrument.

Fig. 32 shows a device whereby the indenting point may be dispensed with in the phonograph. The funnel forming the phonograph is made with a diaphragm at the larger end or mouth-piece, and a very small hole at the pointed end adjacent to the foil on the cylinder q; this foil should be very thin so that the indentations will be made by the direct action of the air waves as concentrated by the funnel without the interposition of the indenting point.

Fig. 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt; this is a convenient arrangement for toys, as the same may be made to imitate the bark of a dog or other noise made by an animal; and this

belt may be of steel or other hard material that allows the same to be used for a long period of time.

Fig. 34 is a perspective view showing a double phonet, there being a spiral line of indentations on each side of the revolving disk d, one phonet coming into action as the other finishes; in this case the spirals should be in opposite directions, so that the disk continuing to revolve in the same direction moves one phonet from the center outwards, and then the other phonet is connected and moved back towards the center; this may be used as a toy.

Fig. 35 represents a phonet in which the phonogram containing a sentence, speech, words, or other sound record is upon a belt or strip wound upon a reel; this belt is drawn along gradually and wound upon the second roller by any suitable mechanism, and as the phonogram is thus moved it actuates the phonet c, b.

Fig. 36 shows a phonograph or phonet similar to that shown in Fig. 12, the cylinder q is revolved, but remains in one positson, and the phonograph or phonet is movable back and forth over the cylinder. In this instance the arm m^2 is extended beyond the screw k^1, and passes beneath the inclined spring guide m^5, when the screw is carrying the arm and phonograph towards the right; as the arm m^2 passes from beneath the end of the guide m^5 it is no longer held to the screw, and the arm m^2 and phonet are lifted by the guide m^5 as the springs m^6 draws the shaft, phonograph, and arm, along to the place of beginning, at which place the arm m^2 drops off the end of the inclined guide m^5 into the thread of the screw, and as this revolves it carries the arm along beneath the guide m^6 as before.

Fig. 37 represents the phonograph or phonet upon a pivoted arm, so that it may swing across or at right angles to the line of movement of the intended material or phonogram. In this case the line of indentations may be lengthwise of the belt, or across the same in the arc of a circle.

Fig. 38 shows a phonograph similar to that shown in Fig. 31, except that the sound chamber is of a different shape.

Fig. 39 shows a mouth-piece with an orifice of soft rubber to fit the mouth or the lips of the person speaking, so that all sound waves will be confined to the chamber and diaphragm.

Fig. 40 shows the mouth-piece of the phonograph made with cross slots with irregular edges.

Fig. 41 shows the mouth-piece as perforated with numerous holes.

Fig. 42 shows but one opening in the mouth-piece; the edges of this are irregular. These irregular edges reinforce the hissing sounds and cause a more perfect phonogram to be produced.

Fig. 43 represents a mouth-piece of mica with a central opening protected at its edges by a wooden ring.

In Fig. 44, the diaphragm b is of wire gauze with a backing of paper connected to it by any suitable cement, and there is a ring of stiff paper at the edges of the gauze disk to strengthen it.

Fig. 45 represents a diaphragm b of parchment or similar material stretched tightly within the frame b^5 by cords and screws. The cords may be of different lengths and tension, and respond to and reinforce certain sounds.

Fig. 46 shows a mouth-piece for the phonet made in imitation of the human mouth.

Fig. 47 represents the body portion of the phonograph or phonet made triangular, and the diaphragm is of corresponding shape.

Fig. 48 represents three cylinders, each provided with a phonograph or phonet; this is useful in recording and reproducing three-part singing or music.

Fig. 49 represents a phonet made as a tube, with flaring or trumpet-shaped ends, and with two diaphragms 15, 16, placed crosswise of the tube so as to form an air chamber. There is a third diaphragm b, which is vibrated by the movement of the reproducing point c, and said diaphragm gives motion to the air in the chamber,

and vibrates the diaphragms 15, 16, which latter produce air waves, and the sounds issuing from the two trumpet-shaped ends will blend and increase the volume of sound.

Fig. 50 represents a device whereby deep indentations are made in the metal foil. Two diaphragms are employed, the first (b^2) is vibrated by the sound vibrations, and controls a valve b^7 in a tube connected with a source of compressed air or other fluid; this valve b^7 allows more or less air to pass to the diaphragm b, according to the vibration of the diaphragm b^2, hence the diaphragm b will vibrate in harmony with the diaphragm b^2, but it will be acted upon by greater force, and consequently the indentations will be deeper in the foil than if the diaphragm b was acted upon simply by the sound vibrations of the voice.

Figs. 51 and 52 represent a device that may be used with a phonet to increase the loudness of the sounds reproduced. The sound vibrations from the phonet are conducted by a tube shown by dotted lines in Fig. 51, to the diaphragm b^3 that controls a valve b^7 in a tube connected with a reservoir of air or other fluid under pressure, and the air as it escapes by the valve passes into the trumpet-shaped end of the tube, and produces sounds that are very loud and clear, and are a reproduction of the sounds resulting from the use of one of the phonets before described.

This same apparatus may be used to reproduce with louder utterances a person's voice, the the sound from the voice being used to vibrate the diaphragm b^3, and thereby regulate the air waves escaping from the valve b^7 into the trumpet.

Fig. 53 shows the speaker's head within a box or case; in this instance nearly all the sound vibrations act upon the diaphragm.

Figs. 54 and 55 illustrate how the movements of the lips in speaking may be recorded and reproduced. In this instance, a lever applied to the diaphragm carries the indenting point c, Fig. 55, and the end of this lever is placed in the mouth of the speaker, and the movement of the lips regulates the indentations in the foil.

A similar apparatus shown in Fig. 54 within a case is connected to the movable lips of a mask, so that these lips open and close as in articulation, at the same time that the sound vibrations are given by the phonogram to the phonet.

Fig. 56 represents a toy phonet in which the phonogram strip 35 is secured at one end to a cylinder upon which it is wound. By pulling upon the strip it is unwound, and a rubber cord 37 is wound upon the shaft of the cylinder. When the hand is removed from the indented strip, the rubber cord rotates the shaft and winds up the phonogram upon the cylinder, and the sounds are reproduced in the phonet by the phonogram acting upon a point and diaphragm a. The movement of the shaft is regulated by the fan, worm, and pinion 38.

In Fig. 57, the cylinder for moving the phonogram strip is shown as provided with pins that enter holes in the edges of the strip; this causes the strip to be fed along very regular.

In Fig. 58, the cylinder with pins is shown as made with heads to act as guides for the strip.

Fig. 59 shows a re-indenting device for amplifying or increasing the size of the indentations. There are two rollers, one of which a^4 travels faster than the other a^5, and there is a lever 40 pivoted at 41, and provided with a point c for each cylinder. One point follows the indentations in the cylinder a^5, and the other rests upon a^4, and as this travels the fastest, the indentations made therein will be longer and also deeper by the point being at the outer end of the lever.

In Fig. 60, one roller 42 of the pair is made of hardened metal with the sound record in relief. This is obtained by electrotype or other process from an iron foil or other metal phonogram, and this roller is used to indent strips or sheets of foil or rollers to produce copies that can be used with the phonet.

Fig. 61 represents a roller 42 of hardened metal with the record in relief, and arranged so as to knurl or indent the phonogram in a roller 43 of soft metal that is to be pressed against the roller 42 by a screw or other suitable means.

The cylinder having a spiral groove in its surface may be made by placing the mould shown in Fig. 62 around a cylinder or shaft, and filling the space between

the cylinder and mold with plaster of Paris or other suitable material. The mold is of metal with a screw or spiral rib projecting therefrom, and it is made in two parts and hinged so that it can easily be removed when the plaster of Paris is dry.

For amusement or instruction, the phonograph is capable of extended use; for instance, a revolving cylinder, see Fig. 63, containing rows of indentations representing the letters of the alphabet, and provided with keys containing corresponding letters, can be used in teaching the alphabet, and sentences, speeches, and other matter can be spoken by the phonet, and repeated by the learner without the eyesight being called into use.

Clocks may be provided with phonogram cylinders or wheels to call off the hours, to give alarms, &c.

The phonogram may be upon a strip, sheet, belt, or roller, and it can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, and these can be used in toy animals with a simple phonet for reproducing the sound.

In copying phonograms, or making duplicates, an original phonogram may receive a deposit of copper or iron in a plating bath; and, if of iron, may be carbonized to convert it into steel and hardened, and then the same should be backed up with type metal, and used for impressing strips or pieces of metal.

A bed of gutta percha, or similar material, may be used to sustain the sheet metal while being pressed. Numerous copies of the original phonogram can thus be reproduced.

A plaster cast can be used for producing a copy by pressure.

The governor to regulate the speed of the instrument may be made of a pendulum weight 61, see Fig. 64, hung at the lower end of a rod that is provided with a universal joint at 62, and the upper end of the rod is moved around by a crank 63 that is revolved by the train of gearing. As the speed increases the weight will describe a circle of larger diameter, and thereby increase the resistance.

The universal joint may be displaced by a spring wire, Fig. 65, that allows of the movement.

A magnet 64 upon the crank arm 63, Fig. 66, may be used to revolve the pendulum by attracting an armature at the upper end of the pendulum rod, and thereby avoid the friction resulting from the contact of the surfaces of the pendulum rod with the crank.

In Fig. 67 the diaphragm *b* is represented as connected to a pair of delicate piston valves within a tube 68 that has three ports; one, 69, is connected to a reservoir of compressed air, the others, 70 and 71, are connected to a number 72 at opposite sides of a diaphragm, so as to vibrate the same in harmony with the diaphragm *b*, but there will be greater amplitude given to the same by the pressure of the air, and by a connection to the phonet diaphragm b^2 the sound produced will be greatly increased.

What I claim as my Invention is,—

First. The combination with the diaphragm and point of a flat receiving surface and means for revolving the receiving surface, and causing the point to follow a volute or spiral line, substantially as represented in Figs. 1, 2, 6, 7, 8, 9, 10, and 34.

Second. The combination with the revolving plate phonograph or phonet of a propelling weight or spring and a governor to regulate the speed, and ensure uniformity of movement, substantially as set forth.

Third. A revolving disk provided with a clamping frame to secure the foil or other material in combination with the swinging arm, diaphragm, and point, substantially as specified.

Fourth. In a phonograph or phonet, a spring introduced between the diaphragm and the point, substantially as set forth and shown in Figs. 16, 17, 18, 19, 22, and 26.

Fifth. In a phonograph or phonet a rubber spring, or similar device, to dampen

the vibration of the diaphragm, and prevent false vibrations, as set forth and shown in Figs. 16 and 21.

Sixth. The combination with the diaphragm in a phonograph or phonet apparatus of a lever to modify the relative action of the diaphragm and point, substantially as described, and shown in Figs. 17, 18, 27.

Seventh. The combination with the diaphragm and point of a permanent or electro-magnet, substantially as described, and represented in Figs. 24, 25, 26.

Eighth. The method of recording and reproducing two or more sounds or speeches simultaneously, substantially as described, and as illustrated by Figs. 28, 29, and 48.

Ninth. A phonet composed of a perforated sirene and a jet tube, substantially as described, and represented in Fig. 30.

Tenth. The mechanism for producing a phonogram, and employing the same in a phonet, substantially as described, and illustrated in Figs. 32, 33, 35, 36, and 37.

Eleventh. The combination with the phonograph, diaphragm, and point of a sound chamber, substantially as described, and illustrated in Figs. 31, 38, 39, and 53.

Twelfth. The diaphragm and mouth-pieces for speaking phonograph, substantially as described, and as illustrated in Figs. 41, 42, 43, 44, 45, and 46.

Thirteenth. The combination with a diaphragm and its point of two diaphragms for the purposes, and substantially as shown in Fig. 49.

Fourteenth. The combination with a diaphragm and valve actuated by sound vibrations a source of compressed fluid and a trumpet, as in Figs. 51, 52, or a phonograph as in Fig. 50, substantially as set forth.

Fifteenth. The combination of two diaphragms with a valve and a source of compressed fluid, as represented in Fig. 67, for increasing the volume of the voice or other sound, as set forth.

Sixteenth. The combination with two or more phonograms of phonet keys for selecting letters or utterances as described, and illustrated in Fig. 63.

Seventeenth. The means for duplicating or reproducing phonograms from an original phonogram, substantially as set forth.

Eighteenth. The combination with the phonograph or phonet of the revolving crank and pendulum governor, substantially as described, and shown in Figs. 64, 65, 66.

Nineteenth. The combination with the phonograph of a lever moved by the lips, and of a lever and phonet to move the lips of a mask, substantially as described, and illustrated by Figs. 55 and 54.

Twentieth. The combination with a phonogram of a clock movement or toy and a phonet for reproducing sounds for clocks or toys, substantially as set forth.

In witness whereof, I, the said Thomas Alva Edison, have hereunto set my hand and seal, this 17th day of September, A.D. 1878.

THOMAS ALVA EDISON. (L.S.)

Witnesses,

CHAS. H. SMITH,
76, Chambers St., New York,

HAROLD SERRELL, 76, Chambers St., New York.

LONDON: Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

1878.

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A.D. 1878. April 24. N° 1644.
EDISON'S Specification.

FIG. 1.

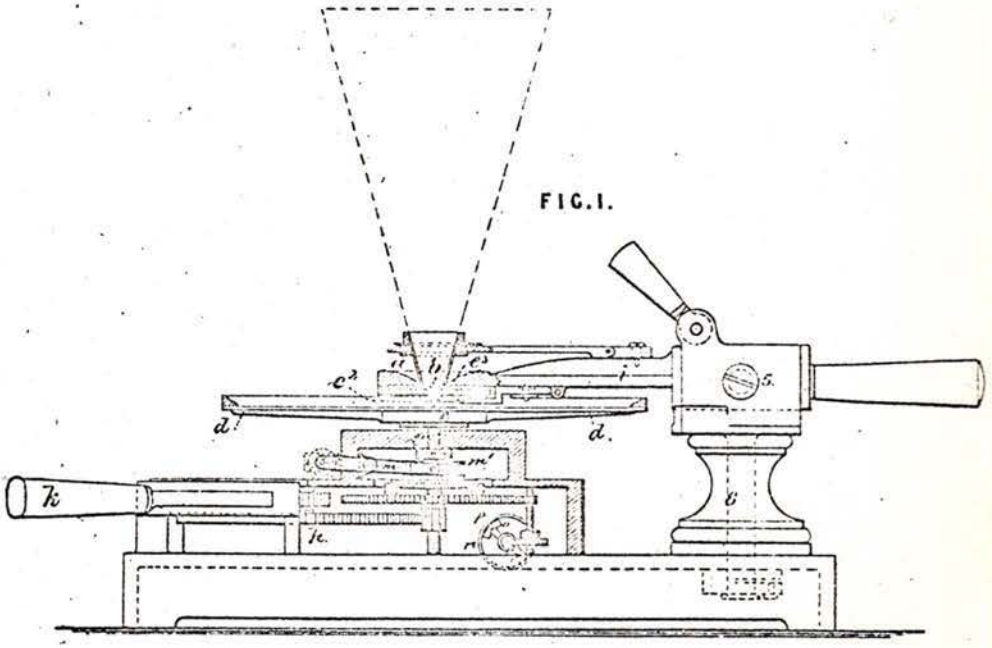

FIG. 2.

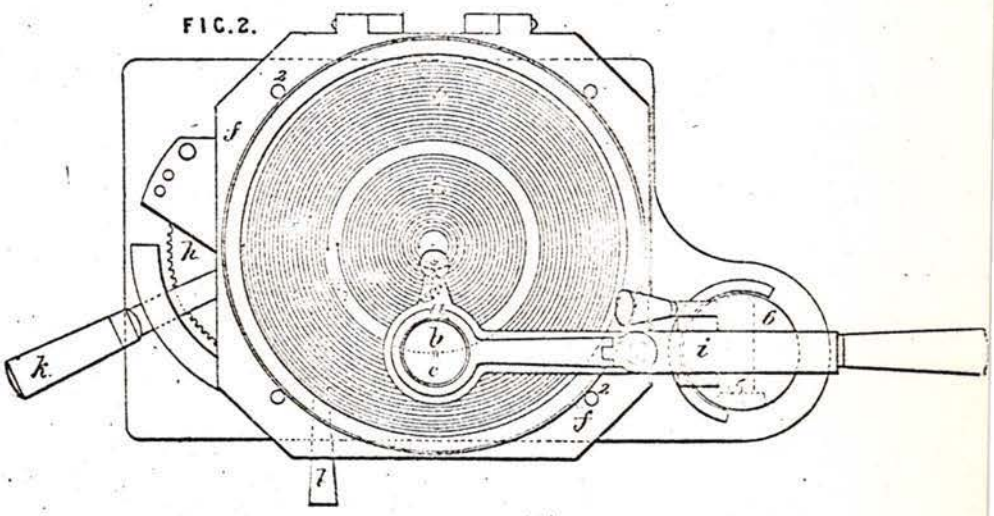

FIG.4.

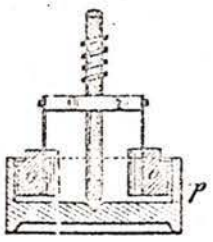

FIG.6.

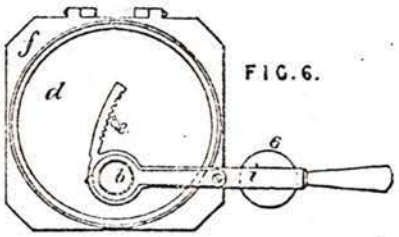

FIG.3.

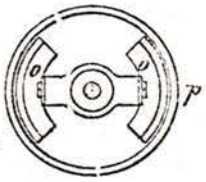

FIG.7.

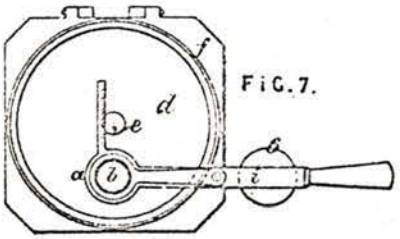

FIG.5.

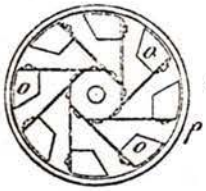

FIG.8.

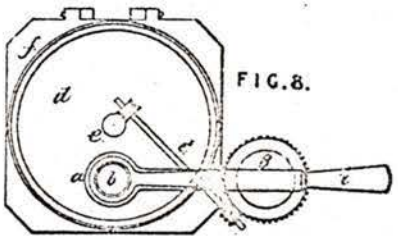

FIG.10.

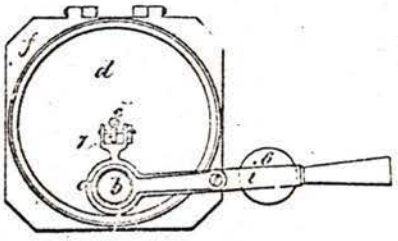

FIG.9.

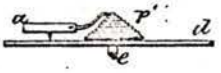

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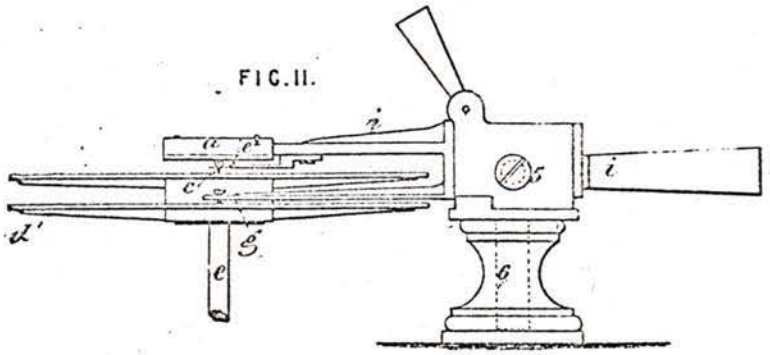
FIG. 11.



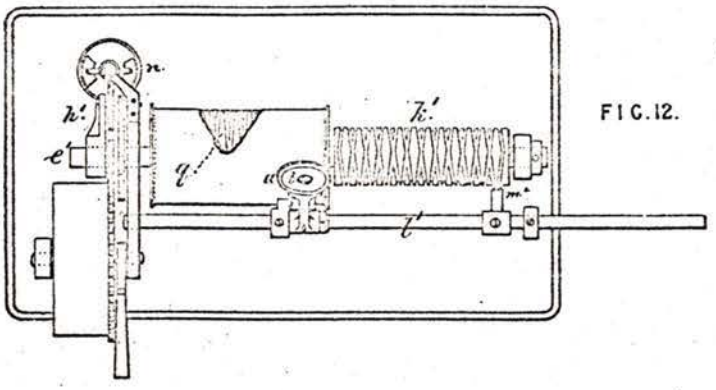


FIG. 12.

FIG. 13.

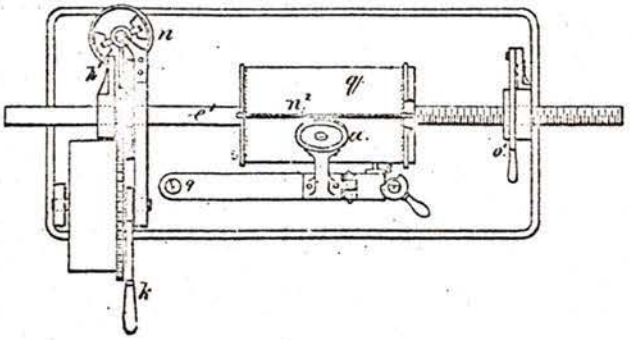


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FIG. 14.

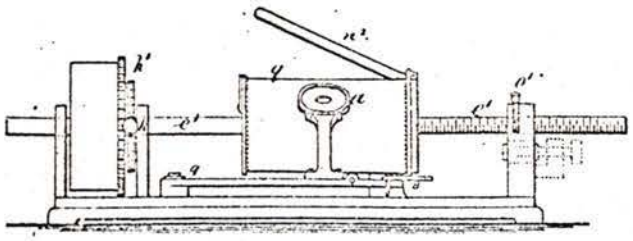
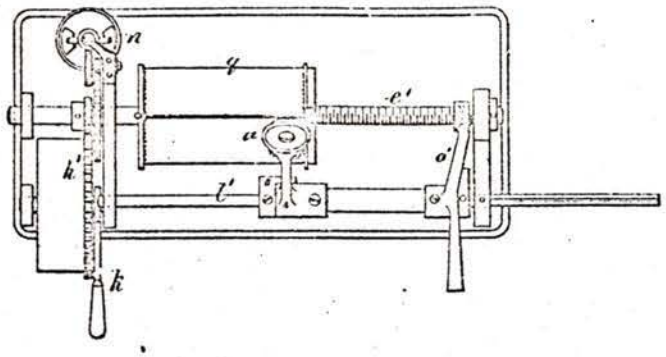


FIG. 15.



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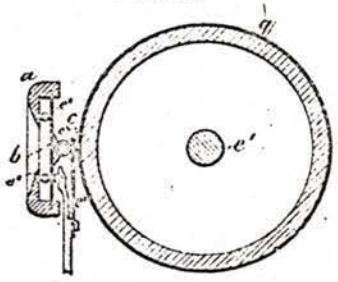

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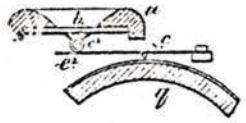
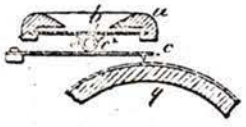


FIG. 18.



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A.D. 1878. April 24. N° 1644.
EDISON'S Specification.

FIG. 19.

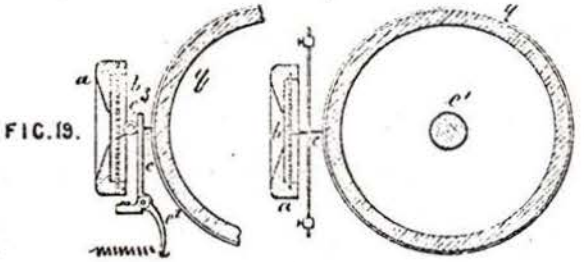


FIG. 20.

FIG. 21.

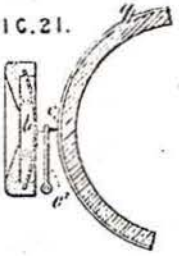


FIG. 22.

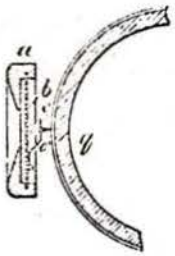


FIG. 23.

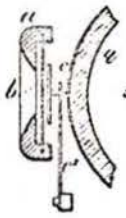
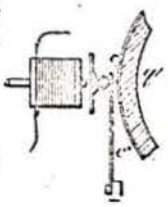


FIG. 24.



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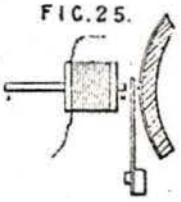

FIG. 26.

FIG. 27.

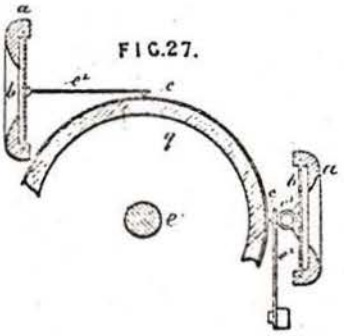

FIG. 28.

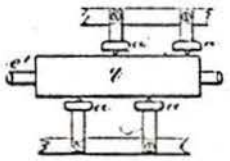

FIG. 29.

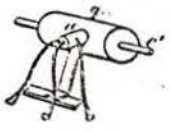

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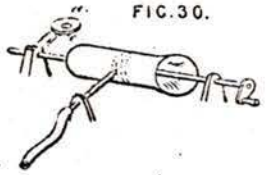
FIG. 30.



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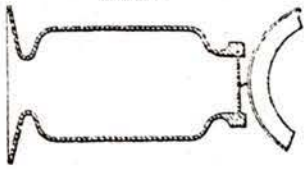

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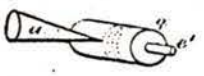


FIG. 33.

FIG. 34.

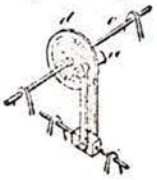


FIG. 35.

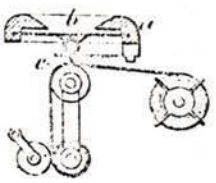


FIG. 36.

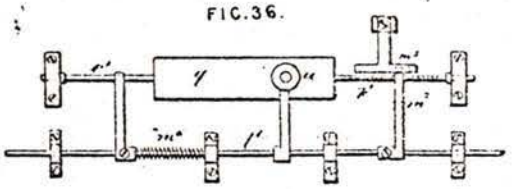


FIG. 37.

FIG. 38.

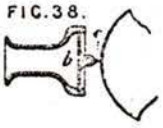


FIG. 39.

FIG. 40.

FIG. 41.

FIG. 42.

FIG. 43.

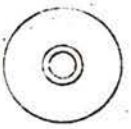


FIG. 44.

FIG. 45.

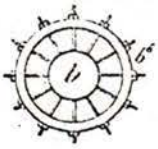
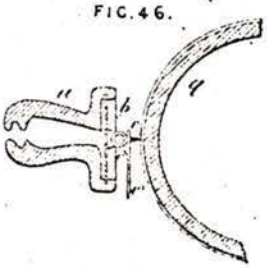


FIG. 46.



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A.D.1878. April 24. N°1644.
EDISON'S Specification.

FIG.48.

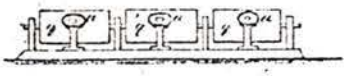

FIG.49.

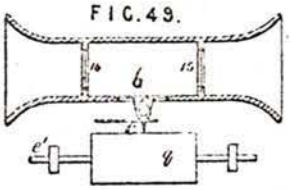

FIG.47.

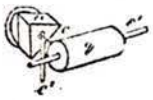

FIG.50.

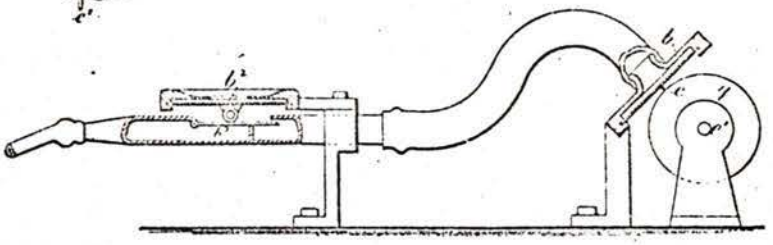

FIG.51.

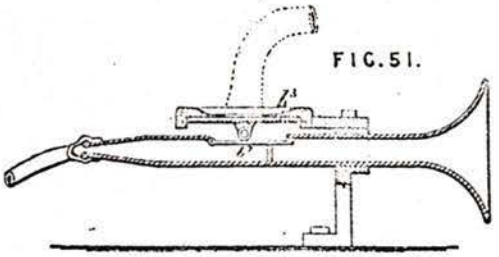

FIG.53.

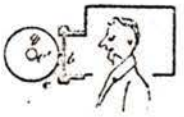

FIG.54.

FIG.52.

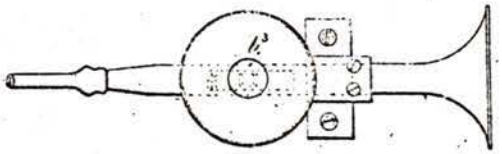

FIG.55.

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FIG. 56.

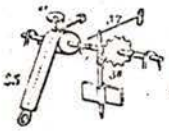
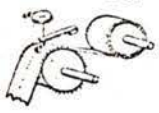


FIG. 57.



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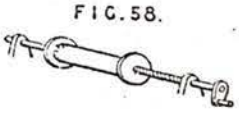


FIG. 59.

FIG. 60.

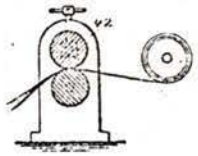
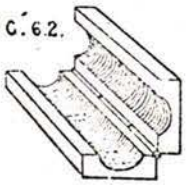


FIG. 61.

FIG. 62.



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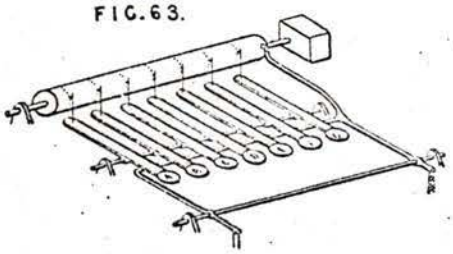

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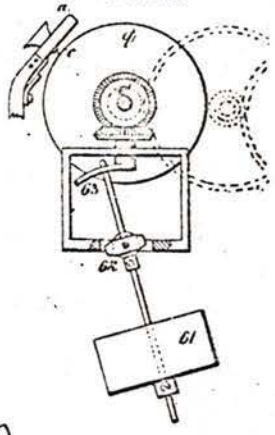

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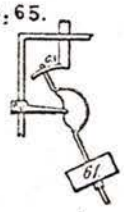


FIG. 67.

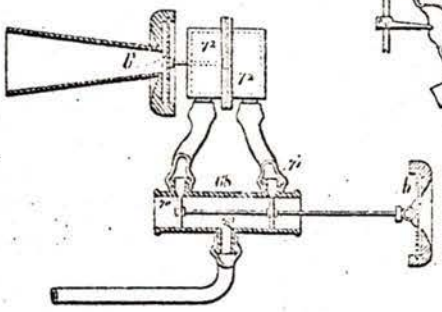
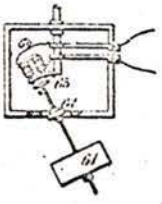


FIG. 66.



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(No Model.) 5 Sheets—Sheet 1.

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166. Patented Oct. 23, 1883.

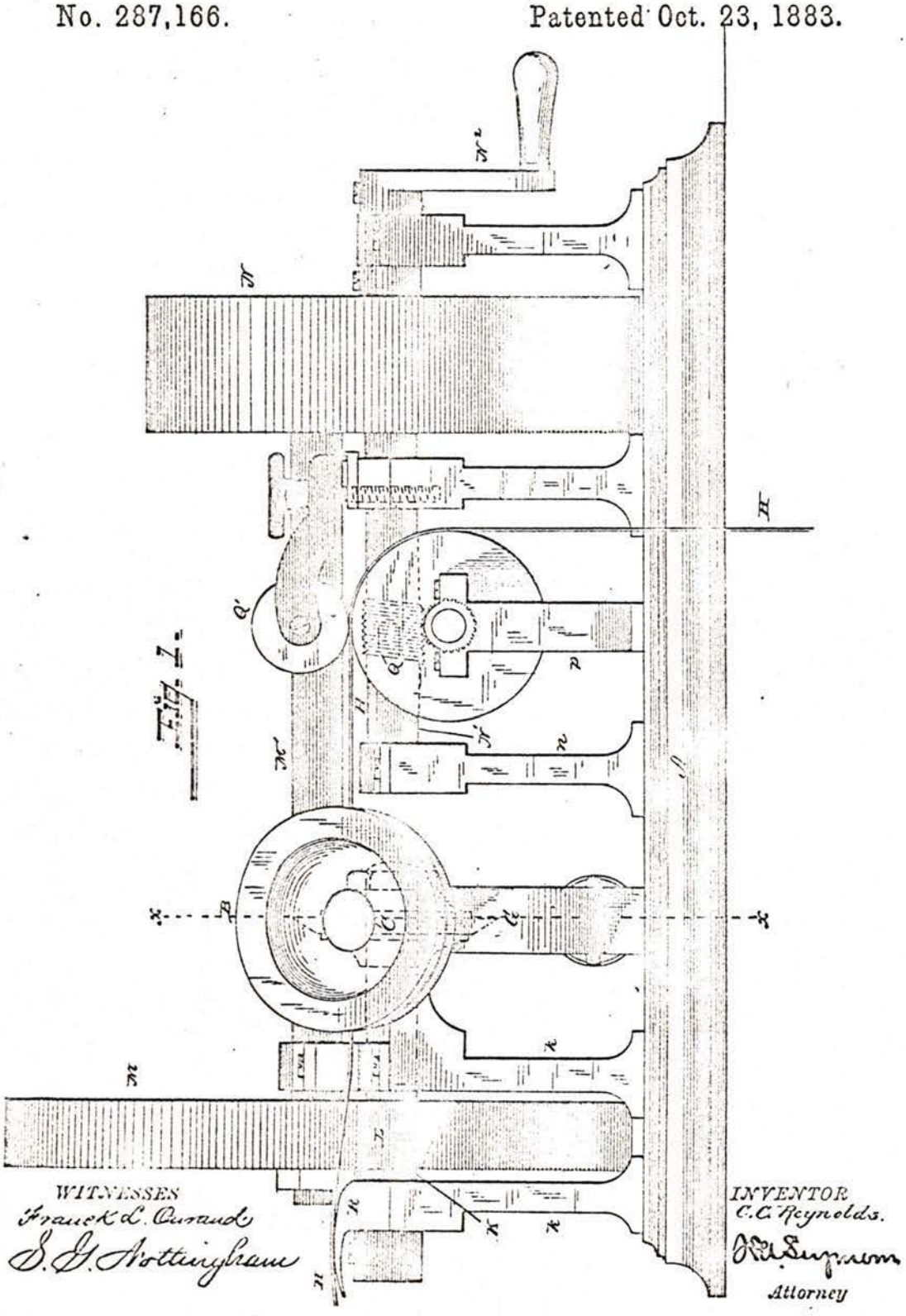

Fig. 1.

WITNESSES
Frank L. Ourand
S. G. Nottingham

INVENTOR
C. C. Reynolds.
By his Attorney

(No Model.) 5 Sheets—Sheet 2.

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166. Patented Oct. 23, 1883.

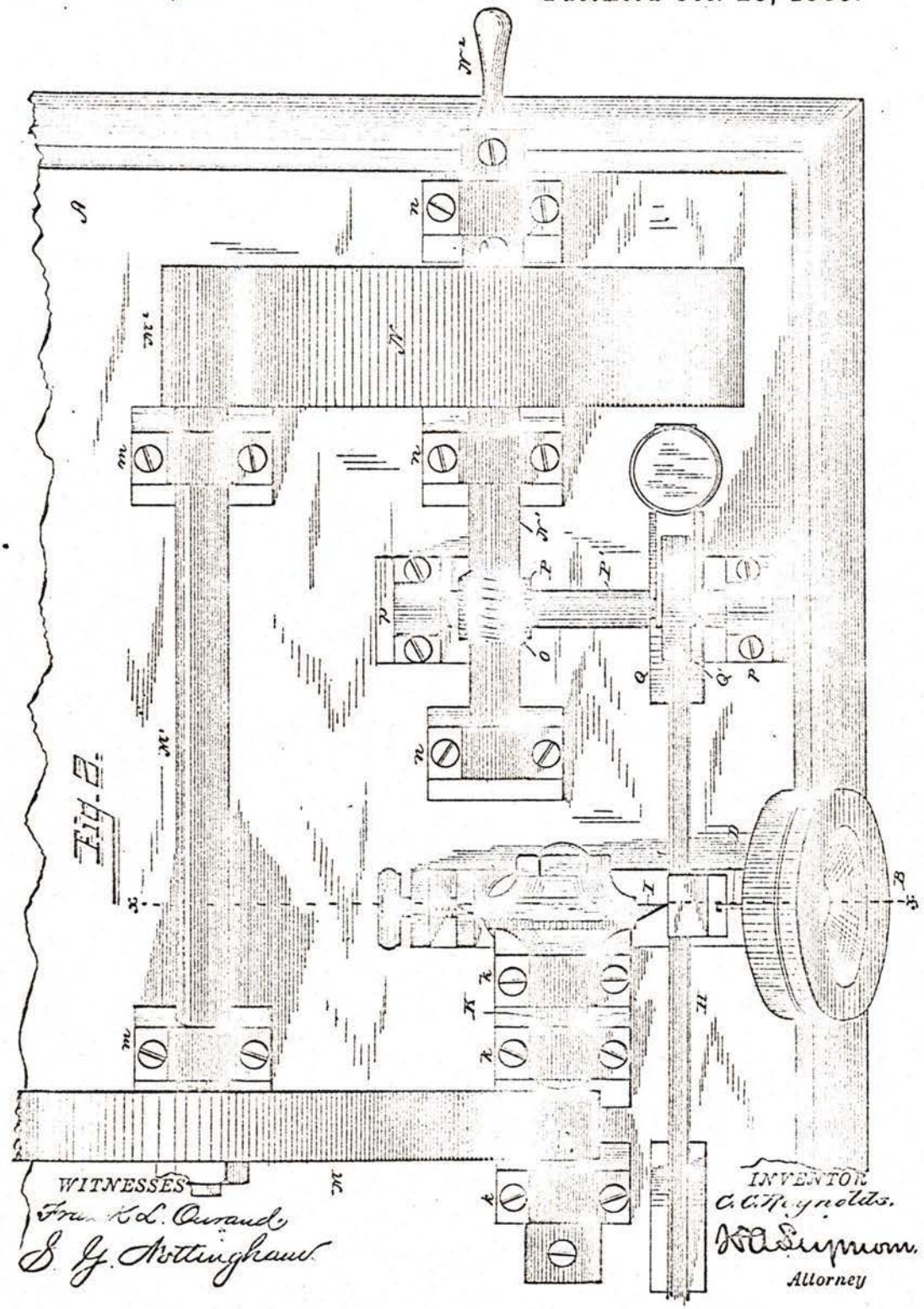

Fig. 2.

WITNESSES
Frank L. Durand
S. J. Nottingham

INVENTOR
C. C. Reynolds.
H. A. Simmons.
Attorney

(No Model.) 5 Sheets—Sheet 3.

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166. Patented Oct. 23, 1883.

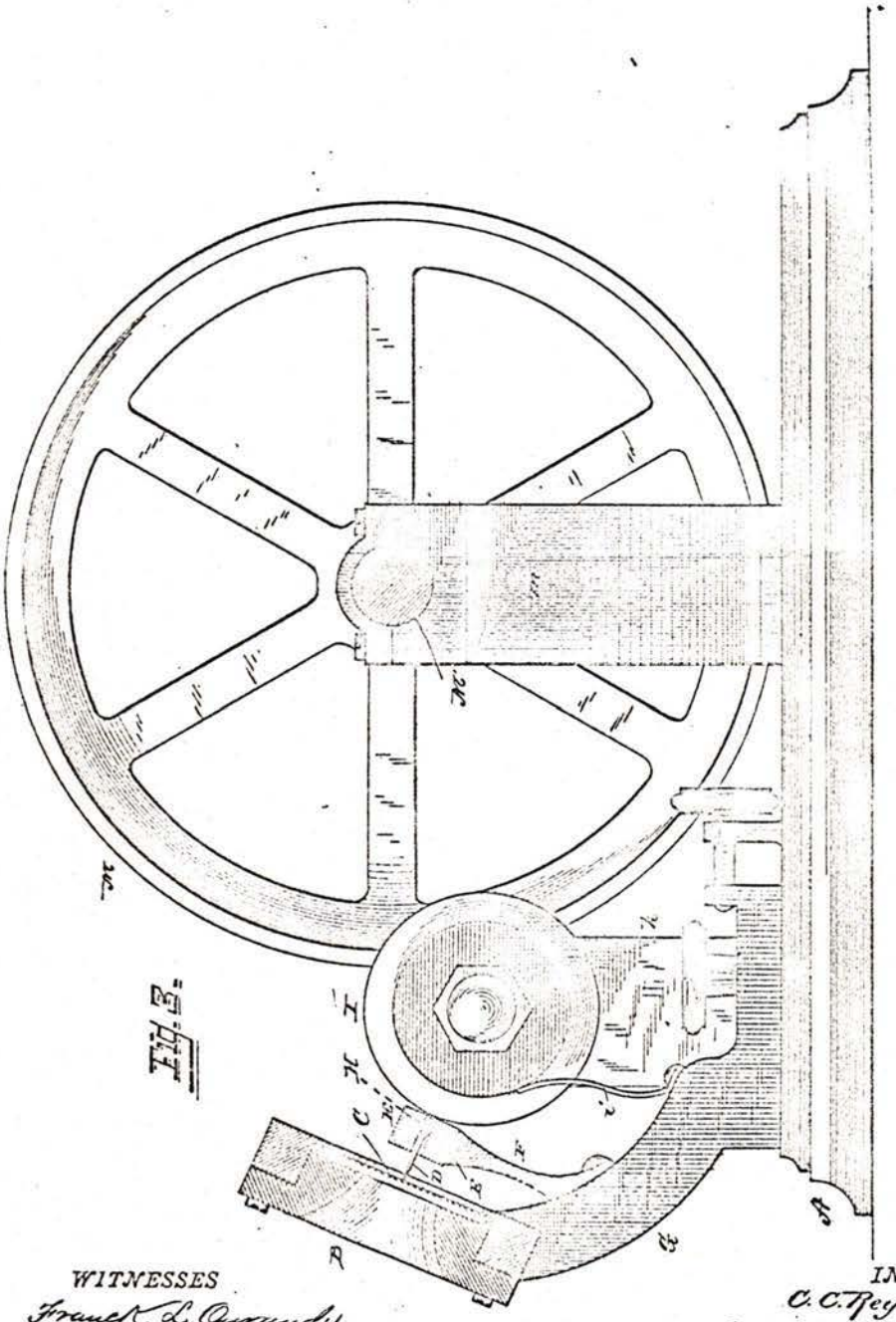

Fig. 2.

WITNESSES

Franck L. Ormund

S. J. Nottingham

INVENTOR

C. C. Reynolds.

by A. A. Seymour.

Attorney

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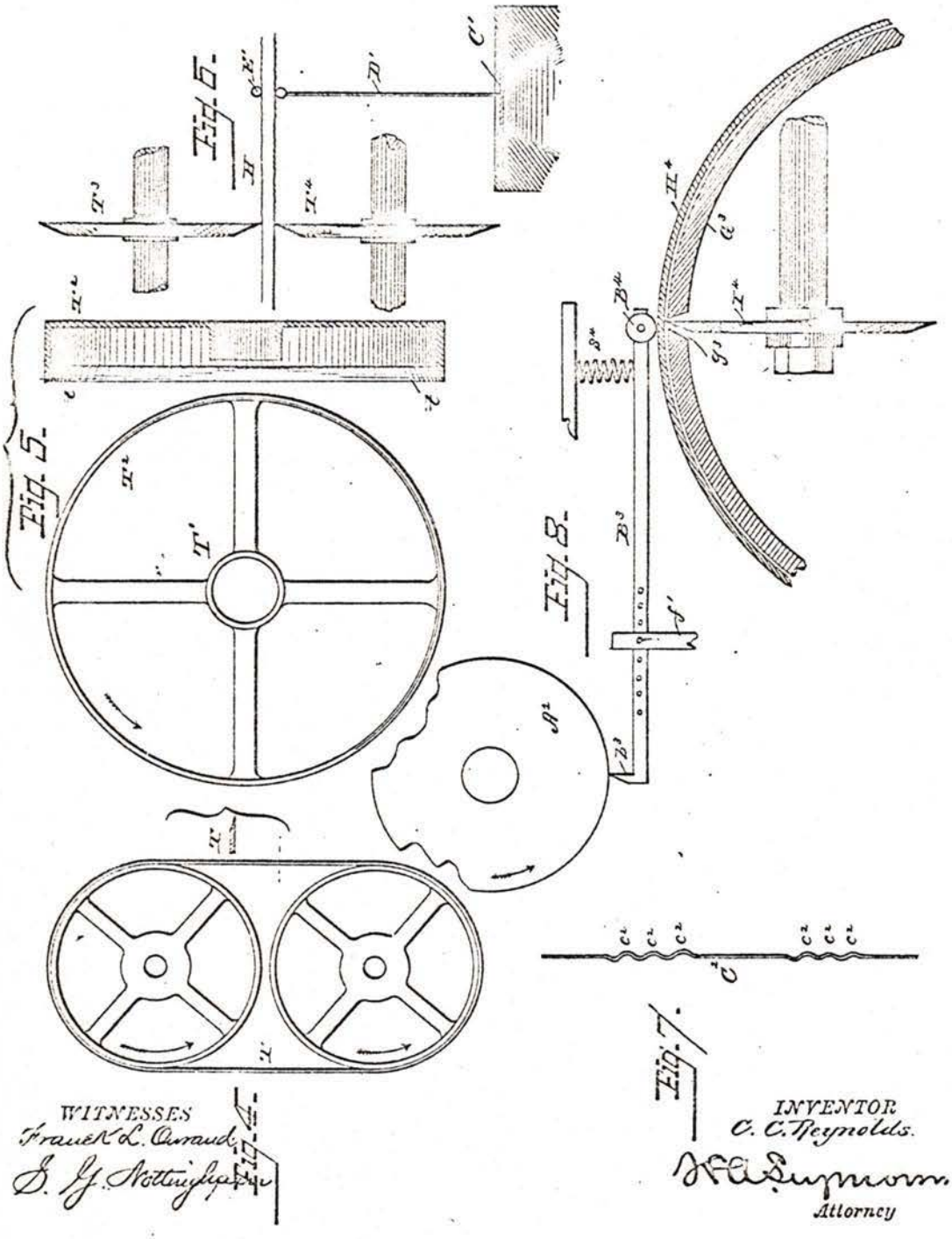
C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166. Patented Oct. 23, 1883.



WITNESSES
Frank L. Ouard
D. J. Nottingham

INVENTOR
C. C. Reynolds.
by F. A. Lehmann.
Attorney

(No Model.) 5 Sheets—Sheet 5.

C. C. REYNOLDS.

PHONOGRAPH.

No. 287,166. Patented Oct. 23, 1883.

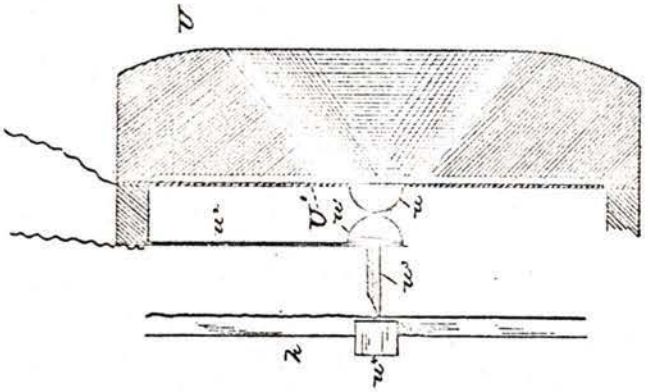


Fig. 9.

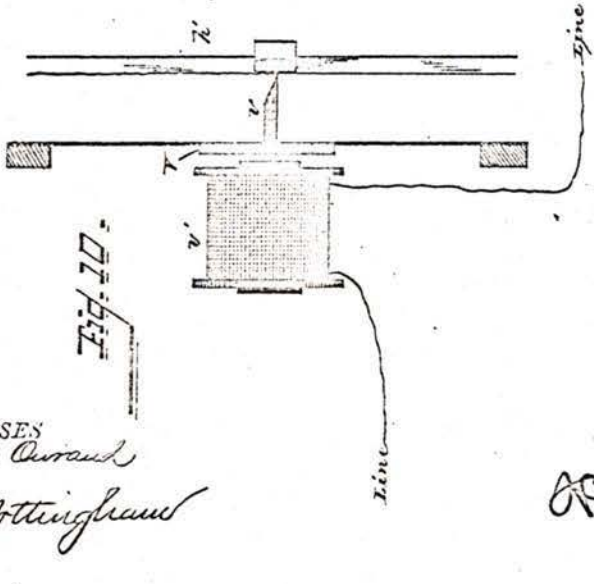


Fig. 10.

Fig. 11.

WITNESSES
Franck L. Ourand
S. G. Nottingham

INVENTOR
C. C. Reynolds.
by A. Seymour.
Attorney

Sheets—Sheet 5.

. 23, 1883.

UNITED STATES PATENT OFFICE.

CHRISTOPHER C. REYNOLDS, OF PRESCOTT, ARIZONA TERRITORY.

PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 287,166, dated October 23, 1883.

Application filed May 23, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER C. REYNOLDS, of Prescott, in the county of Yavapai and Territory of Arizona, have invented certain new and useful Improvements in Phonographic Instruments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in phonographic instruments, and methods by which are produced permanent records of sounds in such form that the sounds may be reproduced through the instrumentality of the records.

Instruments of this class as heretofore constructed have produced the sound-record by embossing or indenting a sheet of tin-foil or similar thin and pliable material, which is supported upon a revolving cylinder or plate to receive the action of a recording-stylus, which is forced directly against the sheet by a diaphragm vibrating in response to sounds, the said cylinder or plate being grooved spirally in order to permit the record-sheet to be forced into the groove to raise the record on one side of the sheet, while it is sunken or indented on the other side. The disadvantages of such an instrument are as follows: First, its capacity for continuous recording is limited by the dimensions of the cylinder or plate which supports the record-sheet; second, removing the sheet from its supporting plate or cylinder destroys the perfection of the record, as the embossing becomes more or less disarranged or obliterated as the thin and soft sheet is subjected to the handling and bending necessarily incident to its removal; third, the embossing is so delicate and fragile that it is distorted by the action of a stylus, with which it is moved in contact for the purpose of reproducing the sounds, and consequently the reproduction is not exact; and, fourth, the resistance which the record-sheet opposes to the recording-stylus prevents the diaphragm from having an amplitude of vibration commensurate with the force of the sound-waves projected against it; and therefore the reproduction will not have the volume or loudness of the original sounds.

It is the object of my invention to provide a phonographic apparatus which is not subject to the disadvantages above enumerated; and to this end it consists in a new method and certain novel constructions and combinations of devices, which will be clearly understood from the following particular description, in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of a phonograph constructed according to my invention. Fig. 2 is a top view thereof. Fig. 3 is a section on the line *x x*, Figs. 1 and 2. Fig. 4 is a view in elevation and diametric section of a modified form of the record-cutter. Fig. 5 is a view in elevation and section of another modification of the record-cutter. Fig. 6 is a plan view of a portion of an instrument adapted to cut the record on both sides of the record-strip. Fig. 7 is a diametric section of a form of diaphragm adapted for use in my improved phonograph. Fig. 8 is a diagram illustrating the construction of an instrument for copying and amplifying an original record made by the old forms of instruments. Fig. 9 is a section of a portion of a telephone-transmitter adapted for transmitting sounds in connection with a record-strip produced by my improved instrument. Fig. 10 is a fragmentary section of another form of telephonic transmitter adapted for operation by the record-strip; and Fig. 11 is a view in cross-section of various forms of strips which may be used to receive the record.

In the drawings, the letter A indicates a base-board, upon which the various parts of my phonograph are mount

B is a mouth-piece, in w... is secured a diaphragm, C, in the manner usual in such instruments, and from the center of this diaphragm projects a stem, D, corresponding to the stylus of the ordinary phonograph. The outer end of this stylus plays between two guides, E E, supported by an arm, F, which projects from the adjustable standard G, which carries the mouth-piece. These guides E are arranged to receive between them the traveling record-strip H, which is guided across the edge of a rotary cutter-plate, I, which is carried by a shaft, K, mounted in bearings at the tops of standards *k*, rising from the base-board. Said shaft has also fixed upon it a friction-

wheel, L, which is driven by a larger friction-wheel, M, carried by a shaft, M', supported by standards *m*, and carrying at its opposite end a friction-pinion, M², which is driven by a main driving friction-wheel, N, carried by a shaft, N', which rotates in bearings on standards *n*. This shaft N' is provided with a worm-gear, *o*, which meshes with a tooth-pinion, P, mounted on a transverse shaft, P', supported by standards *p*, and having fixed upon it a friction feed-wheel, Q, over which passes the record-strip H, said strip being held properly in contact with the periphery of said feed-wheel by means of an adjustable pressure-wheel, Q'.

Near the opposite end of the base-board from the feed-wheel Q, and beyond the guides E E, is a guide, R, which also supports the record-strip and directs it properly between the guides E E. The record-strip, as shown in Fig. 1, is oblong in cross-section, as shown also at H in Fig. 11. It is to be made of a metal which will well support itself and resist ordinary wear—such, for instance, as copper, brass, iron, or soft untempered steel. The dimensions of the strip may be varied; but in practice a strip from one-eighth to three-sixteenths of an inch wide, and from one thirty-second to one-sixteenth of an inch thick, will be found to be of convenient size for general use. It is designed to cut into the edge of this strip indentations or notches corresponding to the record-indentation of the ordinary phonograph, this indented edge to be drawn in contact with a stylus connected with a reproducing-diaphragm in the ordinary manner, and thus reproducing the recorded sounds.

The operation of the apparatus as shown in the drawings will be readily understood. The record-strip H is first passed through the guide R, and then between the guides E in contact with the stem D, and on over the feed-wheel Q and under the pressure-wheel. The strip may be delivered from a suitable reel, (not shown in the drawings,) and after leaving the feed-wheel may be wound upon another reel, or disposed of in any desired manner. The guides and guide-wheel are so arranged that the edge of the strip H will lightly touch the edge of the cutter-wheel I. Now, when the shaft N' is turned by its crank N², motion is transmitted through the friction-wheel N, pinion M², shaft M', friction-wheel M, pinion L, and shaft K to the cutter-wheel I, which has a knife-edge of tempered steel. The relation of the devices for transmitting motion is such that even when the shaft N' is turned comparatively slowly, a very rapid rotary motion will be given to the cutter-wheel. At the same time that motion is being transmitted to the cutter-wheel from shaft N' said shaft also transmits motion through the worm *o*, pinion P, and shaft P' to the feed-wheel Q in the direction indicated by the arrow, and thus, while the cutter-wheel is rotating, the record-strip H is drawn across its edge, and if, while this operation is going on, sounds are produced in front of the diaphragm C, said diaphragm will be caused to vibrate and operate the stem D to drive the record-strip against the cutter-wheel I with a range and force of movement corresponding to the air-vibrations set up by the sounds, and the cutter-wheel will consequently cut notches or indentations into the edge of the record-strip which represent an exact record of such sounds.

It will be readily seen that the cutter-wheel opposes but a slight resistance to the movement of the record-strip, as it is so sharp and its movements so rapid that the edge of the record-strip is easily and rapidly cut away when it is passed against the cutter, even though the strip be of a material and bulk which enable it to sustain a considerable handling and friction when used for reproducing sounds, by drawing its indented edge in contact with a stylus arranged to operate a diaphragm.

It will also be seen that a record of indefinite length may be produced, or short records may be produced in rapid succession, by feeding strips of the desired length to the cutter-wheel.

In order to keep the cutter-wheel clear of particles of metal which might adhere to it, a light spring, *i*, is arranged to bear against each side of said wheel, so as to scrape off the adhering cuttings. This is a great advantage over the old forms of phonographs, in which, as is well known, the extent of the record is limited by the dimensions of the plate or cylinder which supports the foil-strip.

The sounds reproduced by a record-strip formed by my machine approach more nearly the original sounds in loudness and volume than do the sounds reproduced by the old forms of records, as by my improvement so little resistance is opposed to the movement of the strip that the diaphragm has a vibration much more nearly commensurate with the sounds projected against it than is possible when the record must be produced entirely by the force of movement of the diaphragm in driving the stylus against a record-sheet.

The record-cutter need not be limited in form to a simple rotary knife-edged disk. I have contemplated using a cutter operating after the manner of a band-saw, as shown in Fig. 4, in which the letter T indicates a steel band having one of its lateral edges beveled and sharpened to act upon the record-strip.

I may also use a rim-wheel cutter, as shown in Fig. 5, in which the letter T' indicates a spoked wheel having a rim, T², one of the lateral edges of which is beveled to a knife-edge, as shown at *t*.

I may also form the cutter-wheel with cutting-faces, similar to a fine file, to facilitate its cutting and smoothing of the edges of the notches; but such file-faces are not essential.

In Fig. 6 is illustrated a portion of an in-

strument having two cutters, T³ and T⁴, between the edges of which the record-strip H passes, said strip passing also through a guide-eye, E', connected to the stem D', projecting from a diaphragm, C'. In an instrument thus constructed the complete vibration of the diaphragm in both directions is utilized for producing the record, complementary portions of the record being cut in opposite edges of the strip. If such a strip be drawn between a fixed stylus and a movable stylus attached to a reproducing-diaphragm, it is obvious that the two edges of the strip will co-operate in giving the diaphragm vibrations of extensive amplitude, and thus the reproduction of sounds will be very nearly as loud as the original.

In order to give the recording-diaphragm a capacity for free and prompt vibration, I have preferred to form said diaphragm with concentric corrugations, similar to the diaphragms of pressure-gages used for indicating steam-pressure. Such a diaphragm is shown in section in Fig. 7, in which C² indicates the diaphragm, and c^2 c^2 c^2 the corrugations. I have found such a diaphragm very sensitive and efficient in response to sounds.

The essential principle of my improvement may be utilized for reproducing, in durable and amplified form, the fragile records made by the old styles of phonographs. In the diagram Fig. 8 is illustrated the embodiment of my improvement in an apparatus for this purpose. The letter A² designates a cylinder which may be arranged to travel longitudinally, as well as to rotate in a manner similar to that of the cylinder of the old styles of phonographs. B³ is a lever provided with a stylus, b^3, for acting upon an old record-sheet, which may be placed upon this cylinder. Said lever has an adjustable fulcrum, f', and at the end opposite the stylus carries a pressure-roller, B⁴. The letter G³ indicates a supporting-table, against which the roller B⁴ will be pressed by a spring, s^4. This table has an opening at g^3, through which plays the edge of a cutter-wheel, I', which may be given a rotary motion by any suitable means. The letter H⁴ indicates a record-strip, which may be drawn under the wheel B⁴ and across the edge of the cutter-wheel, and if, while the said strip is so drawn, the cylinder A² be rotated, the record-strip thereon will vibrate the lever B³ and cause the roller B⁴ to press the record-strip in contact with the edge of the cutter-wheel with a varying pressure corresponding to the indentations of the record-sheet, which will be thus copied and given the form of a continuous strip. It is obvious that the copy may be much amplified by regulating the position of the adjustable fulcrum, so that the wheel B⁴ will be carried by a long arm having any desired proportion to a shorter arm of the lever B³, which carries the stylus.

The record-strips produced by my improved machine are peculiarly applicable for use in transmitting messages by telephone—as, for instance, should a person desiring to transmit a telephonic message be unable to send his message immediately and have no time to wait, he may prepare a record or message strip by one of my phonographs, and the telephonic operator may use the strip in transmitting the message at a future time, or in its regular order with other messages waiting until the line can be used.

In Fig. 9 the letter U indicates a portion of a telephonic transmitter which may be used for transmitting messages either directly by the voice or through the instrumentality of a record-strip. The letter U' indicates a diaphragm arranged in the mouth-piece in the usual manner, and provided on its rear surface with a carbon button, u, which is in contact with another carbon button, u', carried by a spring, u^2. The carbon button u^2 has projecting from its rear side a stylus, u^3, behind which is a guide, u^4, for a record-strip, h. The diaphragm U and the spring u^2 are supposed to be connected with the primary circuit of an induction-coil in the usual manner. It is not necessary to explain the manner of transmitting directly by the voice; but in case a record-strip, as shown at h, is to be used, such strip is drawn through the guide u^4, with its indented or record edge in contact with the tip of the stylus u^3, and will vibrate said stylus longitudinally, so that the pressure between the buttons u and u' will be varied in correspondence with the indentations of the strip, and thus the current varied in a manner to transmit the message represented by the strip.

In Fig. 10 is illustrated another form of transmitter, in which an armature, V, is provided with a stylus, v, to receive the action of a record-strip, as shown at h', so that said armature will be vibrated in front of the core of an electro-magnet, V', and induced undulatory currents be thus set up in the coil of the magnet in correspondence with the record, such induced currents traversing a line-wire and acting upon a receiver in the usual manner.

As before stated, the record-strip may be given various forms in cross-section—such, for instance, as illustrated in Fig. 11. H indicates the flat strip, oblong in cross-section, and with rectangular edges. H' is a strip triangular in cross-section. H² is a round strip. H³ is a flat strip having double-beveled edges, and H⁴ is a strip having sharp ribs to receive the action of the cutter. These strips may be made of any of the metals hereinbefore mentioned, or any durable material which will withstand the frictional wear and handling incident to their use. It will sometimes be found of advantage to make the record-strip of soft steel and temper or harden it after the record has been cut. Such a strip will obviously be extremely durable.

Having now fully described my invention and explained the operation thereof, I wish it to be understood that I do not confine myself to the precise details of construction shown in

my drawings and heretofore particularly described, but may vary the same in any manner for the better carrying out the essential principles of my improvement.

What I claim is—

1. In a phonograph, the combination, with means for moving a record-strip by sound, of one or more moving cutters arranged to act upon said strip, substantially as described, and for the purpose set forth.

2. In a phonograph, the combination, with the diaphragm and the moving cutter arranged to act upon a strip vibrated by said diaphragm, of feeding mechanism adapted to move a record-strip across the edge of the cutter, substantially as described.

3. In a phonograph, the combination, with the diaphragm and two moving cutters, of feeding mechanism adapted to move a continuous strip between said cutters, and intermediate devices for transmitting a vibratory motion to said strip from the diaphragm, so that the opposite edges of said strip will be alternately pressed against the cutters, respectively.

4. A phonograph-record consisting of a metallic strip having record-indentations of varying character representing sound-waves caused by articulate speech cut through one or more of its edges, substantially as described.

5. The herein-described method of preparing phonographic records, the same consisting in vibrating a record-strip by sounds and causing said strip to be cut during and in proportion to its vibration by a cutting-instrument operated independently of the diaphragm, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHRISTOPHER COLUMBUS REYNOLDS.

Witnesses:

GEO. W. CURTIS,

WILLIAM WILKERSON.

(No Model.)

T. A. EDISON.

PHONOGRAM BLANK.

No. 382,462. Patented May 8, 1888.

Fig. 1.

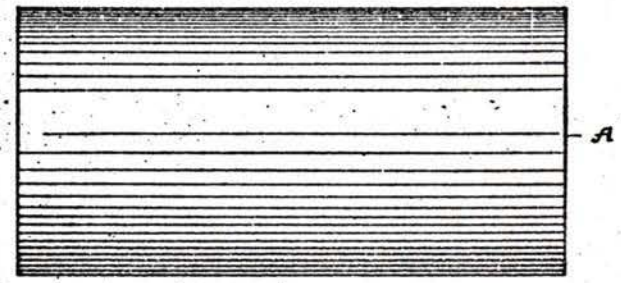


Fig. 2.

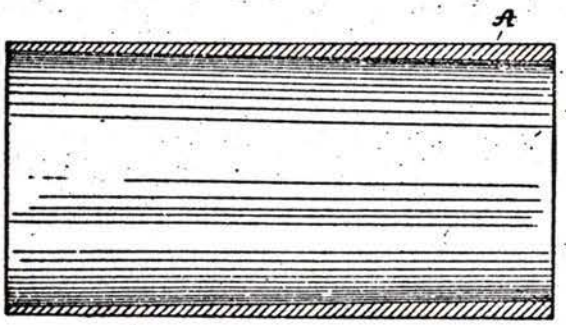
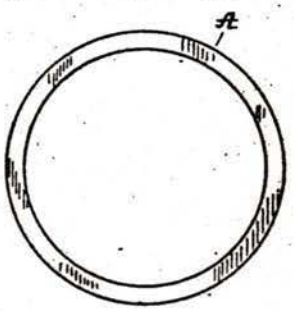


Fig. 3.



Witnesses.
E. C. Howland
William Ceyer

Inventor.
Thomas A. Edison.

By his Attorneys.
Dyer & Seely.

B 5307 Apl 10.88
Pages 1 & 2

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAM-BLANK.

SPECIFICATION forming part of Letters Patent No. 382,462, dated May 8, 1888.

Application filed January 5, 1888. Serial No. 259,896. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonogram-Blanks and Phonograms, (Case No. 747,) of which the following is a specification.

I have found in practice that the most available surface for phonogram-blanks and phonograms is one composed of wax, gum, or other plastic hydrocarbon. Such compounds, however, I find contract and expand under variations of temperature to a much greater extent than paper, wood, metals, and other similar harder substances. While under ordinary conditions the wax or wax-like surface may not be injured by this difference in the coefficient of expansion, yet when subjected to extreme cold the contraction of the wax is so much greater than the harder backing that the wax will crack and destroy the continuity of the surface. For instance, a phonogram-blank or phonogram may be subjected to a temperature of nearly 100° Fahrenheit at one time and at another time the temperature may fall below zero. If the waxy substance is sufficiently hard at the high temperature to hold its shape under the pressure of one on the other in a packing-box, it will at the low temperature harden and contract so greatly in excess of the backing of harder material that the wax will crack and render the surface useless.

The object I have in view is to produce a phonogram-blank or phonogram which will have the wax or wax-like surface and will not be subject to the objection that has been stated. This I accomplish by constructing the phonogram-blank or phonogram wholly of the wax or wax-like material. I prefer to mold the entire phonogram-blank of the one wax-like compound; but I may construct the base or backing of the surface of a somewhat different mixture of wax or wax-like materials than that of which the surface is made, so long as the whole has substantially the same coefficient of expansion.

My phonogram-blank I prefer to mold as a hollow cylinder with a tapering bore for slipping over the tapering phonogram-cylinder of my phonograph.

In the accompanying drawings, forming a part hereof, Figure 1 is an elevation of the phonogram-blank; Fig. 2, a longitudinal section thereof, and Fig. 3 an end view.

A is the cylindrical phonogram-blank, molded of the plastic wax or wax-like material, as described, and having a tapering bore.

The invention is also applicable to duplicate phonograms having the phonographic record thereon.

What I claim is—

1. A phonogram blank or phonogram constructed wholly of wax or wax-like materials and having the same coefficient of expansion throughout its mass, substantially as set forth.

2. A phonogram-blank or phonogram constructed as a hollow cylinder wholly of wax or wax-like materials and having the same coefficient of expansion throughout its mass, substantially as set forth.

3. A phonogram-blank or phonogram constructed as a hollow cylinder, with a tapering bore wholly of wax or wax-like materials, and having the same coefficient of expansion throughout its mass, substantially as set forth.

This specification signed and witnessed this 5th day of December, 1887.

THOS. A. EDISON.

Witnesses:
WILLIAM PELZER,
E. C. ROWLAND.

(No Model.)

T. A. EDISON.

METHOD OF RECORDING AND REPRODUCING SOUNDS.

No. 393,967. Patented Dec. 4, 1888.

Fig. 2.

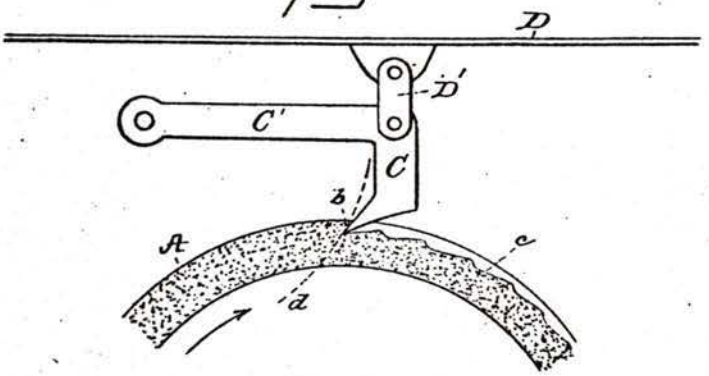


Fig. 1.

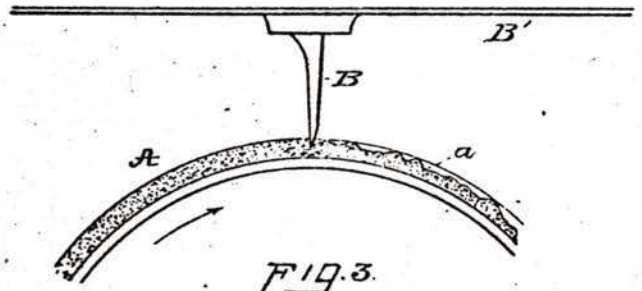


Fig. 3.

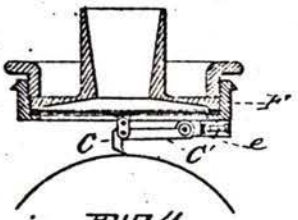
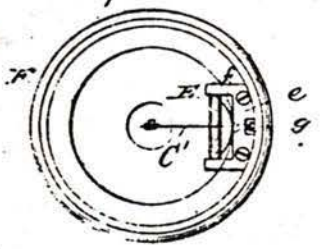


Fig. 4.



WITNESSES:
E. C. Rowland.
William Pyle.

INVENTOR.
Thomas A. Edison.
BY
Dyer & Seely
ATTORNEYS

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

METHOD OF RECORDING AND REPRODUCING SOUNDS.

SPECIFICATION forming part of Letters Patent No. 393,967, dated December 4, 1888.

Application filed July 17, 1888. Serial No. 280,209. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonographs, (Case No. 791,) of which the following is a specification.

For the recording-surface of my phonograph (*i. e.*, the phonogram-blank) I employ a solid material, such as a wax composition or a mixture of metallic soaps capable of being indented by the recording-point. In recording sounds a groove is formed in the material by means of an indenting-point connected with the diaphragm of the recorder, and this groove varies in depth accordingly as the indenting-point is advanced or withdrawn by the vibrations of the diaphragm, thus forming the wave-record from which the sounds are reproduced, as is well understood.

Heretofore the recording-point used has been constructed so that in forming the groove it removed the material by a scraping action. This was due to the fact that the advancing edge of the recording-style used was perpendicular to the recording-surface or receded from the perpendicular, the result being a scraping rather than a true cutting of the material. The scraping action I have found to be productive of false vibrations, which become a part of the record, and which are audible as scratching and other foreign noises when the sounds are reproduced. I have found that this difficulty is overcome by employing a recording-point made as a true cutting-tool with a cutting-edge in advance of the stock of the tool. It might be supposed that a cutting-tool would be unsuitable for the recording-point, and that the heel of the tool would strike the bottom of the groove and prevent the formation of a perfect record, or obliterate the record as made by smoothing or pressing out the indentations more or less; but I have found that the movement of the recording-surface is sufficient to keep the heel of the tool clear of the indentations. This adaptability of the cutting-tool form for the recording-point I consider is also due in a measure to the fact that the recording-point in my phonograph is arranged to act more or less obliquely to the recording-surface, so that the recorded waves will begin gradually and end abruptly. This oblique movement may be accomplished in any of the ways described in my application No. 786, (Serial No. 280,204, filed July 17, 1888,) in which this particular matter is more fully explained. The recording-point in its forward movement advancing against the movement of the recording-surface, the cutting-tool will clear itself just to the extent that its movement advances from the perpendicular, and thus the speed of the recording-surface will be supplemented in the respect of serving to keep the heel of the tool clear by the oblique movement of the cutting-tool. The waves, being abrupt, need not be as deep, and hence there is less difficulty in clearing the tool.

In my phonograph the cutting-tool recording-point is carried by a lever which takes the lateral thrust of the tool and relieves the diaphragm of the strain due to that thrust. This carrying-lever is also pivoted so as to produce the oblique movement of the recording-point before referred to. It also is made light, is provided with friction-bearings to overcome the momentum of the diaphragm and attached parts and to take up lost motion, and it is also positively connected with the diaphragm by a pivoted link or other form of connection which will yield in the direction of the length of the lever, so as to prevent the straining of the diaphragm. While I prefer to employ these several details, yet it is evident that the cutting-tool can be used with phonograph-recorders of various constructions, and hence I do not wish that feature of my invention, except when specially indicated by the claims, to be limited to the details stated. The cutting of the record in the material of the recording-surface, instead of scraping it, makes a clean smooth record, free from imperfections, producing scratching or other foreign noises in the reproducer.

In the accompanying drawings, forming a part hereof, Figure 1 is a view, on an exaggerated scale, illustrating the formation of a record by a scraping-style, as heretofore. Fig. 2 is a similar view illustrating the use of this invention. Fig. 3 is a vertical section of my phonograph-recorder complete, and Fig. 4 is a bottom view of the recorder.

A is the recording-surface, which may be

considered as a wax composition capable of being indented by the recording point or style. It is given a movement in the direction of the arrows, Figs. 1 and 2.

Heretofore the recording-style B has had its advancing edge perpendicular to the recording-surface or receding from it, as shown in Fig. 1. This produced the record *a* by a scraping action. By my invention the recording-point C, Fig. 2, is a cutting-tool having a cutting-edge, *b*, in advance of the stock of the tool. This produces the record *c* by a true cutting action. The style B is attached directly and only to the diaphragm B', and hence the wave record *a* is composed of waves having a symmetrical rise and fall with the deepest part of each wave at its center. The point C is mounted on a pivoted lever, C', connected with the diaphragm D by a pivoted link, D'. The direction of movement of the cutting-edge of the recording-point C is described by the dotted circle *d*; hence it will be seen that the recording-point C acts obliquely to the recording-surface and produces recorded waves, which begin gradually and end abruptly. It will be seen that such is the character of the wave-record *c*. By the movement of the recording-surface and the oblique action of the recording-point the heel of the cutting-tool, forming the recording-point, is kept clear in operation.

From the description that has already been given and an inspection of Figs. 3 and 4 it will be readily understood how my phonograph-recorder is constructed. The lever C' is carried by a bearing-pin, E, which is pivoted in a yoke, *e*, secured to the annular frame F of the recorder. A spring, *f*, bears against the pin E, and is adjusted in its tension by a screw, *g*. This produces a friction at the bearings of the pin E, which overcomes the momentum of the diaphragm and attached parts by retarding their movement, and also takes up all lost motion at the bearings. The spring-friction produces a non-resilient and constantly-acting retarding device. The pivoted link D' prevents the diaphragm from being strained by the differences in movement of the diaphragm and the recording-point by reason of the fact that the link, due to its pivots, yields in the direction of the length of the carrier-lever, while it forms a positive connection between the recording-point and the diaphragm.

I do not claim in this application the machine or apparatus herein described, but only the method of operation, I having been required by the Commissioner of Patents to embody the apparatus in a separate application for Letters Patent.

What I claim is—

1. The method of recording sounds for reproduction, consisting in impressing sound-vibrations upon a cutting recording-point and thereby cutting in the recording-surface the record corresponding to the sound-waves in contradistinction to the formation of such sound-records by a scraping action.

2. The method of recording sounds for reproduction, consisting in impressing sound-vibrations upon a cutting recording-point, and directing the vibrations of such recording-point obliquely to the recording-surface and thereby cutting in the recording-surface a sound-wave record having waves more abrupt at one end than at the other in contradistinction to the formation of such sound-records by a scraping action.

This specification signed and witnessed this 14th day of July, 1888.

THOS. A. EDISON.

Witnesses:
WILLIAM PELZER,
A. W. KIDDLE.

(No Model.)

T. A. EDISON.

PHONOGRAPH RECORDER.

No. 393,968. Patented Dec. 4, 1888.

Fig. 2

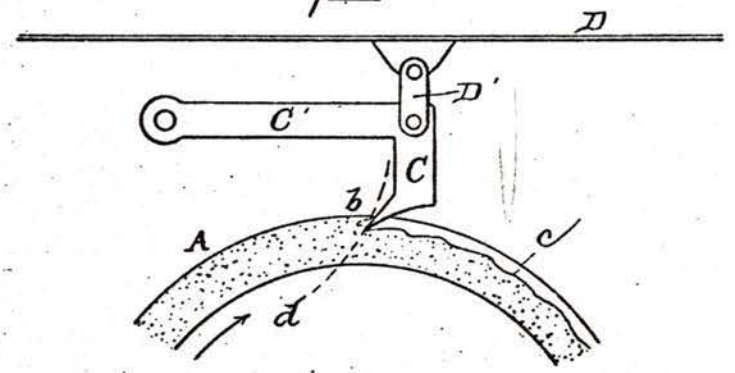


Fig. 1.

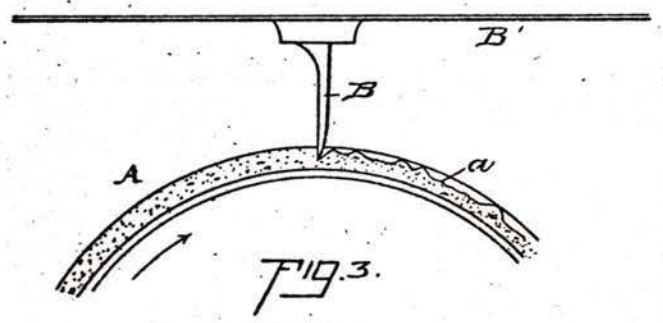


Fig. 3.

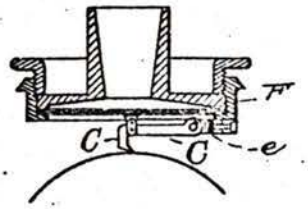
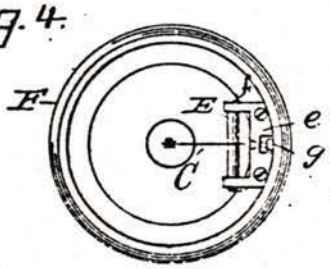


Fig. 4.



WITNESSES:

E. L. Poyland

William Pfyer.

INVENTOR.

Thomas A. Edison

BY

Dyer & Seely

ATTORNEYS.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAPH-RECORDER.

SPECIFICATION forming part of Letters Patent No. 393,968, dated December 4, 1888.

Original application filed July 17, 1888, Serial No. 280,209. Divided and this application filed November 5, 1888. Serial No. 290,023. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonographs, (Case No. 813,) of which the following is a specification.

In my application filed July 17, 1888, Serial No. 280,209, of which this application is a division, is set forth a method of recording sound-vibrations by cutting the record in the recording-surface as distinguished from impressing such record by a scraping action, and also an apparatus for carrying such invention into effect. In that application the method only is claimed, the Commissioner of Patents having required me to embody the apparatus in a separate application.

For the recording-surface of my phonograph (*i. e.*, the phonogram-blank) I employ a solid material—such as a wax composition or a mixture of metallic soaps capable of being indented by the recording-point. In recording sounds a groove is formed in the material by means of an indenting-point connected with the diaphragm of the recorder, and this groove varies in depth accordingly as the indenting-point is advanced or withdrawn by the vibrations of the diaphragm, thus forming the wave-record from which the sounds are reproduced, as is well understood.

Heretofore the recording-point used has been constructed so that in forming the groove it removed the material by a scraping action. This was due to the fact that the advancing edge of the recording-style used was perpendicular to the recording-surface or receded from the perpendicular, the result being a scraping rather than a true cutting of the material. The scraping action I have found to be productive of false vibrations, which become a part of the record, and which are audible as scratching and other foreign noises when the sounds are reproduced. I have found that this difficulty is overcome by employing a recording-point made as a true cutting-tool with a cutting-edge in advance of the stock of the tool. It might be supposed that a cutting-tool would be unsuitable for the recording-point and that the heel of the tool would strike the bottom of the groove and prevent the formation of a perfect record, or obliterate the record as made by smoothing or pressing out the indentations more or less; but I have found that the movement of the recording-surface is sufficient to keep the heel of the tool clear of the indentations. This adaptability of the cutting-tool form for the recording-point I consider is also due in a measure to the fact that the recording-point in my phonograph is arranged to act more or less obliquely to the recording-surface, so that the recorded waves will begin gradually and end abruptly. This oblique movement may be accomplished in any of the ways described in my application No. 786, (Serial No. 280,204,) in which this particular matter is more fully explained. The recording-point in its forward movement advancing against the movement of the recording-surface, the cutting-tool will clear itself just to the extent that its movement advances from the perpendicular, and thus the speed of the recording-surface will be supplemented in the respect of serving to keep the heel of the tool clear by the oblique movement of the cutting-tool. The waves, being abrupt, need not be as deep, and hence there is less difficulty in clearing the tool.

In my phonograph the cutting-tool recording-point is carried by a lever, which takes the lateral thrust of the tool and relieves the diaphragm of the strain due to that thrust This carrying-lever is also pivoted so as to produce the oblique movement of the recording-point, before referred to. It also is made light, is provided with friction-bearings to overcome the momentum of the diaphragm and attached parts and to take up lost motion, and it is also positively connected with the diaphragm by a pivoted link or other form of connection which will yield in the direction of the length of the lever, so as to prevent the straining of the diaphragm.

While I prefer to employ these several details, yet it is evident that the cutting-tool can be used with phonograph-recorders of various constructions, and hence I do not wish that feature of my invention, except when specially indicated by the claims, to be limited to the details stated. The cutting of the record in the material of the recording-surface

instead of scraping it makes a clean smooth record free from imperfections producing scratching or other foreign noises in the reproducer.

In the accompanying drawings, forming a part hereof, Figure 1 is a view, on an exaggerated scale, illustrating the formation of a record by a scraping-style as heretofore. Fig. 2 is a similar view illustrating the use of this invention. Fig. 3 is a vertical section of my phonograph-recorder complete, and Fig. 4 is a bottom view of the recorder.

A is the recording-surface, which may be considered as a wax composition capable of being indented by the recording point or style. It is a given a movement in the direction of the arrows, Figs. 1 and 2.

Heretofore the recording-style B has had its advancing edge perpendicular to the recording-surface or receding from it, as shown in Fig. 1. This produced the record *a* by a scraping action. By my invention the recording-point C, Fig. 2, is a cutting-tool having a cutting-edge, *b*, in advance of the stock of the tool. This produces the record *c* by a true cutting action. The style B is attached directly and only to the diaphragm B′, and hence the wave-record *a* is composed of waves having a symmetrical rise and fall with the deepest part of each wave at its center. The point C is mounted on a pivoted lever, C′, connected with the diaphragm D by a pivoted link, D′ The direction of movement of the cutting-edge of the recording-point C is described by the dotted circle *d;* hence it will be seen that the recording-point C acts obliquely to the recording-surface and produces recorded waves which begin gradually and end abruptly. It will be seen that such is the character of the wave-record *c*. By the movement of the recording-surface and the oblique action of the recording-point the heel of the cutting-tool, forming the recording-point, is kept clear in operation.

From the description that has already been given and an inspection of Figs. 3 and 4 it will be readily understood how my phonograph-recorder is constructed. The lever C′ is carried by a bearing-pin, E, which is pivoted in a yoke, *e*, secured to the annular frame F of the recorder. A spring, *f*, bears against the pin E, and is adjusted in its tension by a screw, *g*. This produces a friction at the bearings of the pin E, which overcomes the momentum of the diaphragm and attached parts by retarding their movement, and also takes up all lost motion at the bearings. The spring-friction produces a non-resilient and constantly-acting retarding device. The pivoted link D′ prevents the diaphragm from being strained by the differences in movement of the diaphragm and the recording-point by reason of the fact that the link, due to its pivots, yields in the direction of the length of the carrier-lever, while it forms a positive connection between the recording-point and the diaphragm.

What I claim is—

1. A phonograph-recorder having for its recording-point a cutting-tool with a cutting-edge in advance of the stock of the tool, substantially as set forth.

2. In a phonograph-recorder, the combination, with the diaphragm, of a cutting-tool recording-point connected with the diaphragm and mounted to move obliquely to the recording-surface, substantially as set forth.

3. In a phonograph-recorder, the combination, with the diaphragm, of a cutting-tool recording-point connected with the diaphragm, and a non-resilient constantly-acting retarding device for retarding the movement of such point in both directions, substantially as set forth.

4. In a phonograph-recorder, the combination, with the diaphragm, of a cutting-tool recording-point connected with the diaphragm, a lever carrying such point, and a positive connection between the point and the diaphragm, which connection is constructed to yield in the direction of the length of the lever, substantially as set forth.

This specification signed and witnessed this 31st day of October, 1888.

THOMAS A. EDISON.

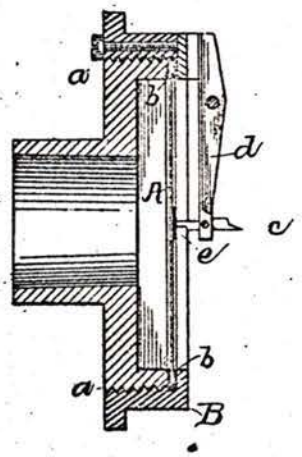
Witnesses:
WILLIAM PELZER,
E. C. ROWLAND.

(No Model.)

T. A. EDISON.

PHONOGRAPH RECORDER AND REPRODUCER.

No. 400,646. Patented Apr. 2, 1889.



WITNESSES:
E. Howard
W. Dyer

INVENTOR.
Thomas A. Edison
BY
Dyer & Tibbey
ATTORNEYS.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY, ASSIGNOR TO THE EDISON PHONOGRAPH COMPANY, OF NEW JERSEY.

PHONOGRAPH RECORDER AND REPRODUCER.

SPECIFICATION forming part of Letters Patent No. 400,646, dated April 2, 1889.

Application filed June 7, 1888. Serial No. 276,384. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonograph Recorders and Reproducers, (Case No. 775,) of which the following is a specification.

The object I have in view is to produce a perfect diaphragm for the recorders and reproducers of phonographs, one which will maintain its adjustment and give the maximum effects under varying conditions of heat and moisture due to atmospheric changes as well as to the breath of the operator in the case of a recorder.

I have found that by employing a film or membrane of glass or its equivalent porcelain as the diaphragm of the recorder or reproducer the difficulties heretofore encountered are effectively overcome. I preferably employ microscope-glass, but other varieties of glass may be employed provided it is made thin as a film or membrane, so as to be capable of a sufficient amplitude of vibration to make or reproduce a proper record. I have employed glass films or membranes for this purpose having a thickness of six one-thousandths to twelve one-thousandths part of an inch; but while the best results are obtained with glass of extreme thinness, yet thicker glass has advantages over materials heretofore employed. The glass film is cut into a circular form of proper diameter by a diamond, and is clamped between metallic rings with some yielding material—such as paper placed around the edges of the glass on both sides. The glass film or membrane diaphragm is not materially affected by ordinary variations of heat and moisture, it has great elasticity, and is highly responsive to sound-vibrations, and is capable, by reason of its extreme thinness, of sufficient amplitude of vibration to make or reproduce a deep record. Hence it does not get out of adjustment, and gives at all times the maximum effects, producing as a recorder a uniformly excellent record.

In the accompanying drawing, forming a part hereof, the figure represents a sectional view of a recorder embodying the invention.

A is the diaphragm of the recorder, which is a film or membrane of glass or its equivalent for the purpose—porcelain. This diaphragm is held at its edges in the annular frame B by a screw-ring, *a*, rings of paper *b* being placed between the glass diaphragm and the clamping-surfaces to hold the diaphragm firmly and prevent cracking.

The recording-point *c* is secured to a lever, *d*, and is attached to the center of the diaphragm by means of cement, *e*. The diaphragm is also equally applicable to phonograph-reproducers.

The glass or porcelain diaphragm I have found to have advantages over mica, which has heretofore been used by me, since the mica, by reason of its laminated structure, does not equal the glass in stiffness and elasticity.

It will be understood that when I refer herein to the diaphragm as of glass I mean to include porcelain as an equivalent.

What I claim is—

1. In a phonograph, the recorder or reproducer having in combination with the recording or reproducing point a diaphragm of glass, substantially as set forth.

2. In a phonograph, the recorder or reproducer having in combination with the recording or reproducing point a diaphragm of microscope-glass, substantially as set forth.

3. In a phonograph, the recorder or reproducer having in combination with the recording or reproducing point a diaphragm of glass clamped between metallic rings with rings of yielding material around the edges of the glass diaphragm, substantially as set forth.

4. In a phonograph, the recorder having in combination a glass diaphragm and a recording-point secured directly thereto by a suitable cement, substantially as set forth.

This specification signed and witnessed this 22d day of May, 1888.

THOS. A. EDISON

Witnesses:
WILLIAM PELZER,
A. W. KIDDLE.

(No Model.)

T. A. EDISON.

PHONOGRAM BLANK.

No. 414,761. Patented Nov. 12, 1889.

FIG 1.

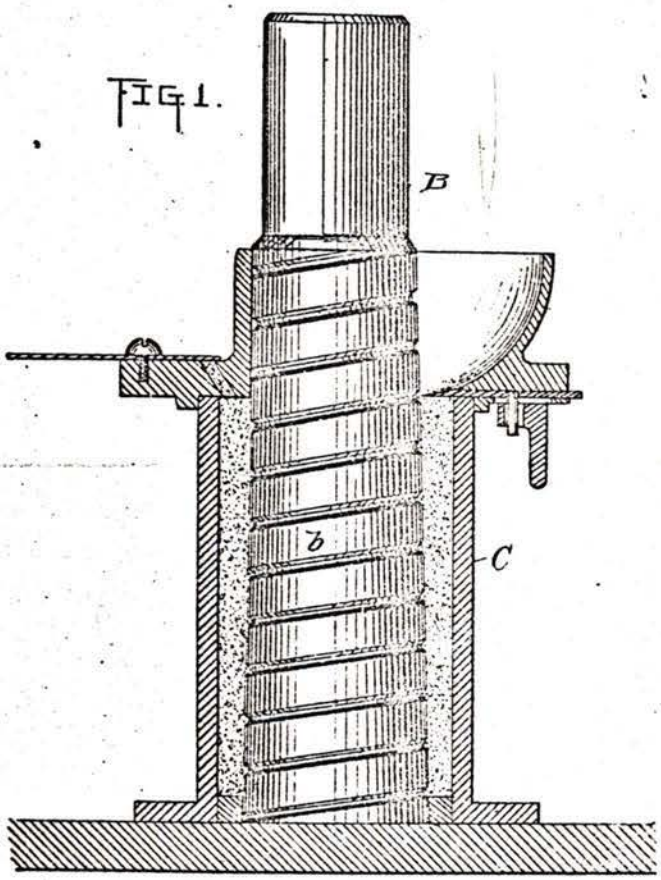
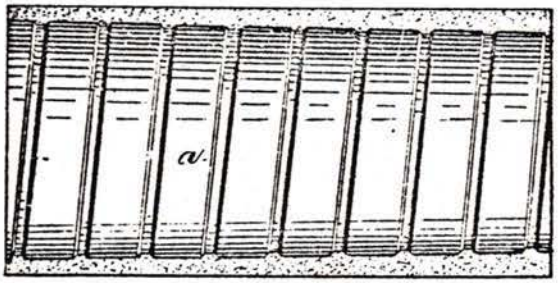


FIG 2.



Witnesses
E. L. Rowland
William Pelzer

Inventor
Thomas A. Edison

By his Attorneys
Geo. Ethridge

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAM-BLANK.

SPECIFICATION forming part of Letters Patent No. 414,761, dated November 12, 1889.

Application filed August 10, 1889. Serial No. 320,398. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonogram-Blanks, (Case No. 840,) of which the following is a specification.

My invention relates to cylindrical blanks for receiving sound-records in the phonograph, made of wax or wax-like or similar materials, and designed to be placed on the cylinder of the phonograph for receiving and reproducing the sound-record. Heretofore these cylinders have been made with a smooth inner surface fitting closely upon the cylinder of the phonograph. I have found that several advantages arise from providing the interior of the cylindrical phonogram-blank with ribs, flanges, or projections, and it is in this that my invention mainly consists. This construction makes it easier to remove the molded blank from the mold in which it is formed, enables the injurious effects of contraction or warping of the cylinder to be readily removed, and prevents any bad effect from the accumulation of dust on the cylinder of the phonograph. I prefer to form a spiral rib on the interior surface of the blank.

My invention is illustrated in the accompanying drawings.

Figure 1 is a view illustrating the process of molding the blank, the mold being shown in section; and Fig. 2 is a longitudinal section of the complete phonogram-blank embodying my invention.

Referring to Fig. 2, A is the cylindrical blank, having a tapering bore and a true cylindrical outer surface, and made of a suitable molded material capable of receiving impressions of the recording-point in the phonograph. On the interior of the cylinder is formed a spiral rib *a*. In making such a cylinder I prefer to employ a cylindrical tapering core B, on the surface of which is formed a spiral groove *b*, and which is placed in the mold C, of the kind described in my prior applications and patents, and the material for forming the blank is poured into the mold around the core, so that as it hardens it forms a cylindrical body having a tapering bore and formed with a spiral rib on its inner surface. I find it easier to remove such a blank from the core than one having a smooth inner surface, since by slightly turning or screwing the same it can be readily withdrawn.

In the process of molding the blank while the material cools it sometimes becomes contracted or warped on its inner surface, so that it does not fit the phonogram-cylinder truly, and in this case it has to be reamed out to remove the irregularities. This has to be allowed for in making the blanks, and when the blank is made with a smooth interior the whole inner surface often has to be cut in order to make it true, and this is a matter of some difficulty and incurs a risk of injury to the blank. Where the blank is formed with an internal rib or ribs and such warping occurs, it is only necessary in order to remove it to cut away the edges of the ribs, and thus a blank having a true inner surface can be formed with less labor and expense and waste of material than where the smooth surface is used. I make the ribs always deep enough to allow for the reaming out of the cylinder. Another advantage is that when the blank is placed on the phonogram-cylinder any particles of dust or other foreign substance which may be on the cylinder enter and remain in the spaces between the ribs, instead of coming between the blank and the cylinder, where they might prevent the blank from assuming a true position and resting evenly thereon.

What I claim is—

1. A tubular phonogram-blank provided with internal ribs or projections, substantially as set forth.

2. A tubular phonogram-blank having an internal spiral rib, substantially as set forth.

3. A tubular phonogram-blank made of molded material and molded with ribs or projections on its inner surface, substantially as set forth.

This specification signed and witnessed this 16th day of July, 1889.

THOS. A. EDISON.

Witnesses:
D. H. DRISCOLL,
WILLIAM PELZER.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAM-BLANK.

SPECIFICATION forming part of Letters Patent No. 430,274, dated June 17, 1890.

Application filed July 30, 1888. Serial No. 281,454. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, In the County of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonogram-Blanks (Case No. 793), of which the following is a specification:

My invention relates to phonogram-blanks for receiving a record of sound-vibrations and reproducing the same; and my object is to produce blanks having superior qualities for recording and reproducing such vibrations.

To this end my invention consists, mainly, in making such blanks, which are preferably of cylindrical form, of soap of the character hereinafter described. Said material may be employed alone or mixed with other materials, such as waxes, resins or gums.

Insoluble soap may be formed of any metal or sometimes of an earthy oxide, like lime, in combination with any fatty acid. For my purpose, however, it is best to use lead, magnesium or aluminium, combined with oleic or stearic acid, forming an oleate or stearate of the metal used. These compounds are preferred because of their superior amorphous quality. Of the metals named I especially prefer to employ lead, and especially to use a mixture of equal quantities of oleate and stearate of lead, the same being melted and poured into molds to form the cylindrical blanks.

The soap may be made according to the usual well-known methods.

What I claim is :

1. Phonogram-blanks made of metallic soap, substantially as set forth.

2. Phonogram-blanks made of lead soap, substantially as set forth.

3. Phonogram-blanks made of a mixture of oleate and stearate of lead, substantially as set forth.

This specification signed and witnessed this 14th day of July, 1888.

THOS. A. EDISON.

Witnesses :

WILLIAM PELZER.

A. W. KIDDLE.

(No Model.)

T. A. EDISON.

PHONOGRAPH.

No. 430,278. Patented June 17, 1890.

FIG. 1.

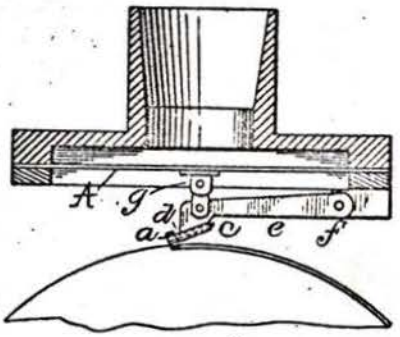


FIG. 2.

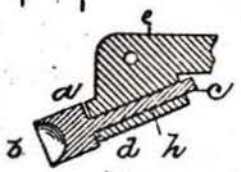


FIG. 4.

FIG. 3.

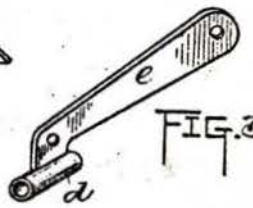


FIG. 5.

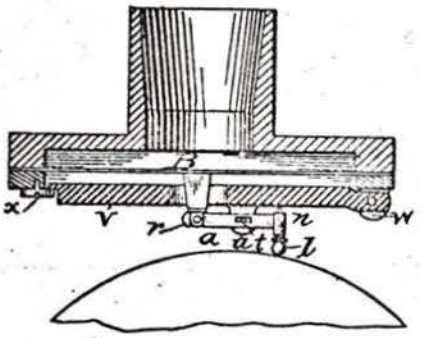


FIG. 6.

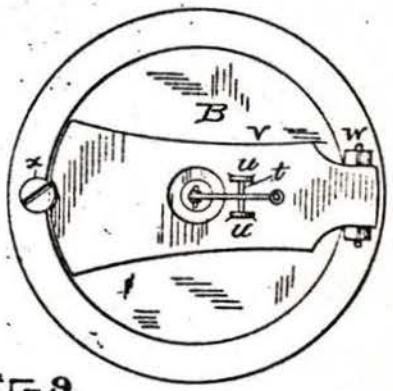


FIG. 7.

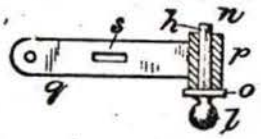


FIG. 9.

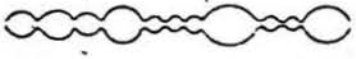


FIG. 8.

Witnesses
E. C. Rowland,
William Pelz

Inventor
Thomas A. Edison

By his Attorneys
Geo. H. Story

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 430,278, dated June 17, 1890.

Application filed April 10, 1889. Serial No. 306,670. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Phonographs, (Case No. 833,) of which the following is a specification.

This invention relates to the recording and reproducing points of the phonograph, and has for its objects such an improvement in the form and construction of such devices and in the manner of arranging and supporting the same as, in the first place, to materially improve the character of the sounds produced by the instrument, so as to make them more accurately reproduce the sound-vibrations communicated to the recorder than has heretofore been found possible; secondly, to make the instrument of a less delicate character and more readily manipulated and adjusted by inexperienced persons, and, thirdly, to enable the recording-point to be used for a longer period of time without having to be sharpened or reground or replaced by another.

One feature of my invention consists in the use of a recording-point having a cutting-edge, which is a portion of the edge of a cylinder and forms a gouging-edge, or one which cuts a rounded groove, so that the indentations due to the movements of such point are circular and with curved sides sloping to the center instead of square, and with straight sides, such as are produced by the straight-edged cutting-points which have heretofore been used. I prefer to employ a recording-point whose end is formed into a complete circular edge—that is to say, the end of a cylindrical head is cupped or hollowed out so as to produce a thin circular cutter, so that when one part of the edge becomes worn or dulled the stem may be turned and a different part of the circumference or a new curved cutting-edge is brought into position to operate on the phonogram-blank. To readily accomplish this and also to produce a means of holding the recording-point which shall enable the latter to be readily removed and easily replaced in position by unskilled persons, I provide the point with a shank which is inserted into a socket and held therein removably, preferably by means of a little cement, which can be readily softened by heat, such as a small quantity of shellac. I prefer to support the reproducing-point in the same way, so that it also can be readily removed and replaced when necessary. I employ, also, a reproducing-point having a convex circular bearing-surface—that is to say, a bearing-surface which is the surface of a portion of a sphere. I prefer to employ as a reproducing-point a ball or sphere at the end of a suitable stem. This is supported so that it has a slight movement laterally of the record, and when traveling in the circular depressions formed by the recording-point it fits such depressions, and even if the lever which carries it is out of line with the record, so that the ball does not stand vertically in the record, or if it bears against the curved sides of the depressions, it reproduces the vibrations with the same exactness. The effect of the weight of the reproducing-point and attached parts is such, however, that the point always tends to go to the bottom or center of a depression. With the curved recording-point the whole depression forms the record of the sound-wave, and not only the bottom of it as with a straight recording-point, so that if the spherical reproducer touches the surface of the depression at any point it gives an accurate reproduction.

If a straight-sided reproducing-point gets out of line or tilted laterally, it does not reproduce accurately, and with straight-sided depressions if the reproducing-point bears against the sides it does not reproduce perfectly and it cuts through the sides and scrapes against them so as to produce imperfect articulation and injure the record itself.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a section of the case and mouth-piece of the recorder with the recording-point and attached parts shown in elevation and with the point itself on an enlarged scale; Fig. 2, a longitudinal section of the recording-point and holder therefor; Fig. 3, a perspective view of the holder and the lever which carries it; Fig. 4, a perspective view of a modified form of recording-point; Fig. 5, a

view of the reproducer, similar to Fig. 1; Fig. 6, a bottom view of the reproducer; Fig. 7, a side elevation of the reproducing-point and the parts which hold and support it, the tubular holder being shown in vertical section; Fig. 8, a view of a modified form of reproducing-point; and Fig. 9, an illustration of the form of the record produced by the arc-shaped recording-point, the view being of the character of a plan view.

The recording-point consists, preferably, of a cylindrical piece *a*, whose end is hollowed or cupped out, as illustrated in Fig. 2, so that a very fine and sharp circular edge *b* is formed. From the part *a*, which is the head of the recording-tool, a shank *c* extends, which is preferably round, and which enters a tubular holder *d*, attached by soldering or otherwise to the lower side of the usual lever *e*, pivoted at *f* on the rim of the reproducer, and connected at *g* with the center of the diaphragm A. Preferably the shank *c* is cemented in the holder *d* by the application of a little shellac or other suitable material *h*, which can readily be softened by heating it; but instead of this the secure removable attachment of the shank in the sleeve may be attained by suitable mechanical holding devices of various kinds, as will readily be seen.

It will be seen that only the lower portion of the circular tool meets the surface of the phonogram-blank, so that the cutting-edge in use at any time is shaped as the arc of a circle whose center is outside of the recording-surface. The circle of the cutting-edge is in practice exceedingly small, being necessarily exaggerated for illustration in the drawings. For a phonograph which has one hundred threads to the inch on its feed-screw, I prefer to make the diameter of the circular cutting-tool about forty-thousandths of an inch. It is of course not necessary for the production of the peculiar character of record desired that the edge shall be a complete circle. It may be a semi-circle or other portion of a circle, as illustrated in Fig. 4, in which the head *i* is formed at its lower side only with a cutting-edge *k*, shaped as the arc of a circle whose center is outside the recording-surface and provided like the other with a shank *c* for insertion in the holder. But by making it circular I provide several curved cutting-edges—two or more—and I enable the same recording-point to be used for a much longer time without having to be replaced or sharpened, for when any portion of the edge has been used long enough to become worn or dulled the cement in the holder may be softened by the application of a low degree of heat and the shank turned in the holder or withdrawn and inserted in a different position, so as to bring a fresh arc-shaped cutting-edge into operative position, and this may be repeated several times before the whole circumference has been used. It will be seen that this is an operation which does not require especially skillful manipulation, but can readily be performed by any one, and this is an important advantage because the phonograph must necessarily be placed usually in the hands of unskilled and inexpert persons. The advantages of the pecular form of holder are, however, not confined to its use with the circular cutting-edge, for this evidently is a desirable form of holder for recording and reproducing points of any character when the same are provided with shanks or extensions capable of being inserted and held in the holder, since it enables such recording or reproducing points to be readily removed and replaced by any one without the exercise of any especial skill or knowledge and without any delicate adjustment, the parts being so arranged that when the head or other enlarged portion meets the holding-sleeve, the point is in the proper position for operation. It is evident, also, that the holding-sleeve and shank are not necessarily round in cross-section, since the same may readily be made square or of other polygonal shape. Of course in this case the shank cannot be turned in the sleeve; but it can readily be withdrawn, turned, and replaced in a new position.

The character of the record produced by the curved or arc-shaped cutting recording-tool is indicated in Fig. 9. It will be seen that such record takes the form of a series of circular pits or depressions whose walls curve toward the center or bottom point, and that the width of such depressions is in proportion to their depth, and also that every portion of each depression contains the record of the sound-wave, so that if the reproducer enters the depression and touches at any point it will receive the required movement corresponding to the impressed sound-wave.

The head of the reproducing-point is preferably a ball or sphere *l*, but it may be only a portion *m* of the sphere, as illustrated in Fig. 8. Such head preferably has a shank *n*, provided with a flange *o*, and such shank enters the holding-sleeve *p* until the flange meets the holder and is secured preferably in the same manner as hereinbefore described with reference to the recording-point—that is to say, by a small quantity of shellac or similar cement *h*, or screwed in.

The holder *p* is attached to or made in one piece with a lever *q*, which is connected at *r* in the usual manner by a hinge with the center of the reproducing-diaphragm B. The lever *q* has a slot *s*, and through such slot passes a pin *t*, extending between lugs *u*, which depend from a plate *v*, pivoted at *w* on the rim of the reproducer and kept from falling out of place by the head *x* of the screw on the opposite side of the rim from the pivot. The plate *v* forms a weight which bears on the reproducing-point and tends to force the same always to the bottom of the recorded indentations, the slot *s* allowing a slight lateral rocking movement of the reproducing-point so that if the lever is out of line with the record the point itself can rock into the

required position, and its having a rounded bearing-surface makes it immaterial whether it stands straight in the depression or is inclined toward one side thereof. The weight *v* also forms a retarding device, such as is described and claimed in my patent, No. 397,280, dated February 5, 1889, since it does not move under the quick vibrations communicated to the reproducing-point by the sound-record, but under slow movements due to irregularities or inaccuracies of the surface of the phonogram or eccentric movements of rotation it yields and permits the reproducing-point to conform to such irregularities.

What I claim is—

1. In a phonograph, the combination, with a diaphragm, of a recording-point carried thereby having a curved cutting-edge, substantially as set forth.

2. In a phonograph, the combination, with a diaphragm, of a recording-point carried thereby having a circular cutting-edge, substantially as set forth.

3. In a phonograph, the combination, with a record-surface, of a recording-point having a curved cutting-edge and entering said record-surface in an oblique direction, substantially as set forth.

4. In a phonograph, the combination of a cylindrical phonogram-blank, a diaphragm, and a recording-point carried by the diaphragm having a curved cutting-edge, substantially as set forth.

5. In a phonograph, a recording-point having two or more cutting-edges, in combination with a holder holding such point normally in a fixed position, and in which such position may be changed to bring such cutting-edges successively into operating position, substantially as set forth.

6. In a phonograph, a recording-point having two or more arc-shaped cutting-edges, in combination with a holder holding said point normally in a fixed position, and in which the position of the point may be changed to bring such edges successively into operating position, substantially as set forth.

7. In a phonograph, a recording-point having a circular edge, in combination with a holder holding such point normally in a fixed position, and in which the position of the point may be changed, substantially as set forth.

8. In a phonograph, a recording-point having two or more cutting-edges, in combination with a holder in which the point may be turned to bring such cutting-edges successively into operating position, substantially as set forth.

9. In a phonograph, the combination of a recording or reproducing point having a shank or extension, and a sleeve for holding the same, substantially as set forth.

10. In a phonograph, the combination, with a holding-sleeve, of a recording or reproducing point having a shank, and an enlarged portion meeting said sleeve when the shank is inserted therein, substantially as set forth.

11. In a phonograph, a reproducing-point whose bearing-surface is the surface of a portion of a sphere, substantially as set forth.

12. In a phonograph, a spherical reproducing-point, substantially as set forth.

13. A sound-record consisting of circular indentations or depressions having rounded sides and corresponding to the sound-waves, substantially as set forth.

14. A sound-record consisting of circular indentations or depressions having rounded sides and corresponding to the sound-waves, in combination with a diaphragm and reproducing-point whose bearing-surface is the surface of a portion of a sphere, substantially as set forth.

15. In a phonograph, a reproducing-point pivoted so as to have a lateral movement, in combination with a weight bearing thereon, substantially as set forth.

16. In a phonograph, a reproducing-point having a bearing-surface which is the surface of a portion of a sphere and pivoted so as to have a lateral movement, in combination with a weight bearing thereon, substantially as set forth.

17. In a phonograph, a reproducing-point having a bearing-surface which is the surface of a portion of a sphere and pivoted so as to have a lateral movement, substantially as set forth.

18. In a phonograph, a laterally-rocking spherical reproducing-point, in combination with a weight bearing thereon, substantially as set forth.

19. A sound-record consisting of circular indentations or depressions corresponding to sound-waves, in combination with a reproducing-point whose bearing-surface is the surface of a portion of a sphere, and which is pivoted so as to have a lateral movement, substantially as set forth.

20. In a phonograph, the combination of the reproducing-point, the lever carrying the same and connected with the diaphragm, the hinged plate, and the hinge-connection between said lever and said plate, substantially as set forth.

21. In a phonograph, the combination of the reproducing-point, the lever carrying the same and connected with the diaphragm and having a longitudinal slot, the hinged plate, the lugs on said plate, and the pin connecting said lugs and passing through said slot, substantially as set forth.

22. In a phonograph, a recording-point having a cylindrical head provided with a cutting-edge and a shank or extension, substantially as set forth.

23. In a phonograph, a recording-point having a cylindrical head with its end hollowed to form a circular cutting-edge, substantially as set forth.

24. In a phonograph, a recording-point hav-

ing a cylindrical head with its end hollowed to form a circular cutting-edge and a shank or contracted extension, substantially as set forth.

25. In a phonograph, a reproducing-point having a head whose bearing-surface is a portion of the surface of a sphere, and a shank or contracted extension, substantially as set forth.

26. In a phonograph, a reproducing-point having a spherical head and a contracted shank, substantially as set forth.

27. In a phonograph, a reproducing-point having a spherical head, a contracted shank, and a flange on said shank, substantially as set forth.

28. In a phonograph, the combination, with a diaphragm, of a sleeve connected with said diaphragm so as to receive motion therefrom and a recording or reproducing point removably and rigidly held in said sleeve, substantially as set forth.

29. In a phonograph, the combination of a diaphragm, a lever connected therewith, a sleeve carried by said lever, and a recording or reproducing point removably held in said sleeve, substantially as set forth.

30. In a phonograph, the combination of a diaphragm, a lever connected therewith, a sleeve carried by said lever, and a recording or reproducing point having a head and a shank or contracted extension removably held in said sleeve, substantially as set forth.

31. In a phonograph, a recording or reproducing point in combination with a holding sleeve and a cement, such as will be softened by heat, holding said point in said sleeve, substantially as set forth.

32. In a phonograph, the combination of a recording-point having a curved cutting-edge and a reproducing-point having a rounded bearing-surface, substantially as set forth.

This specification signed and witnessed this 8th day of April, 1889.

THOMAS A. EDISON.

Witnesses:

WILLIAM PELZER,

D. H. DRISCOLL.

(No Model.)

T. A. EDISON.

PHONOGRAPH CUTTING TOOL.

No. 484,583. Patented Oct. 18, 1892.

Fig. 1.

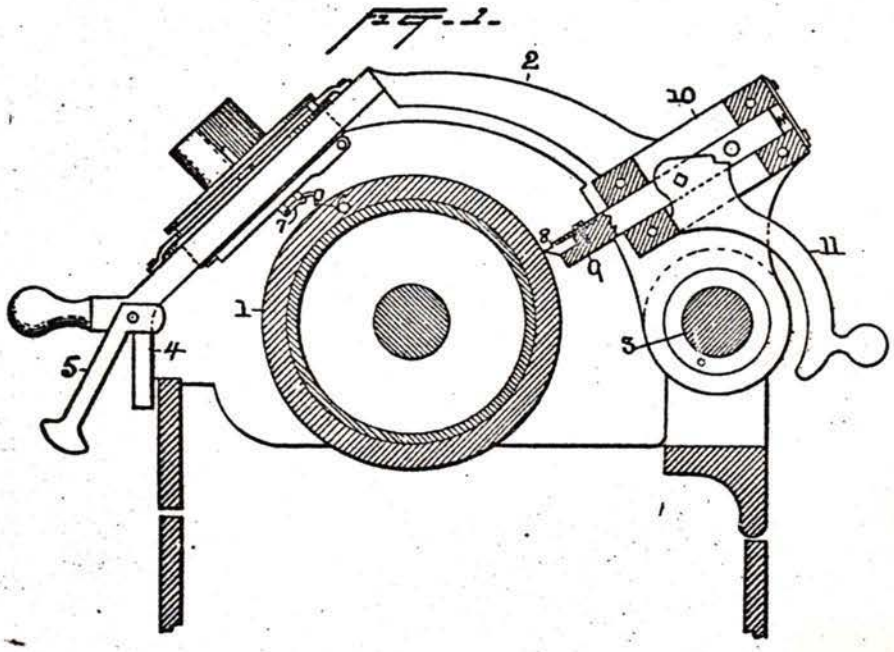


Fig. 2.

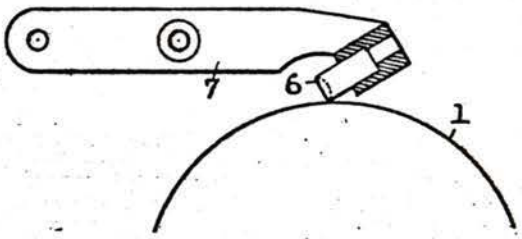
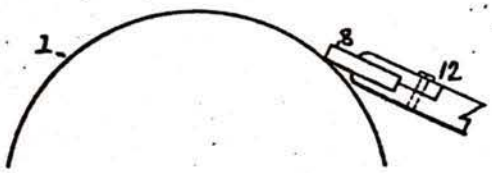


Fig. 3.



Witnesses
Morris A. Clark.
Charles M. Catlin.

Inventor
T. A. Edison,
By his Attorneys
Dyer & Seely.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

PHONOGRAPH CUTTING-TOOL.

SPECIFICATION forming part of Letters Patent No. 484,583, dated October 18, 1892.

Application filed May 27, 1890. Renewed March 30, 1892. Serial No. 427,012. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Phonograph Cutting-Tools, (Case No. 861,) of which the following is a specification.

In practice it is found that after phonographs have been in use for a time the articulation of the speech reproduced is not so smooth and clear as when the phonograph was first put in use. While the articulation is sufficiently good to be intelligible, the false or extraneous vibrations are such as to cause unpleasant and sometimes confusing noises at the reproducer. I attribute this to the fact that by continued use the cutting-edge of the recorder and of the turning-off tool and the bearing point or end of the reproducer become roughened and this causes false marks to be made on the phonogram-blank. The recording-surface of the phonogram-blank is ordinarily of wax or a stearate or hard metallic soap or other wax-like material or composition, and it would naturally be supposed that a tool of steel of the best quality would be entirely satisfactory for use in connection with such a comparatively-soft substance. I have, however, found that such tools are subject to the objection above set forth. This is due to the chemical action of acids or other substances found in the wax-like material or composition of which the phonogram-blank is made and to the dulling and roughening action of fine particles of silica or other hard material which become mixed with the wax-like material during the manufacture of the blank or which become lodged on the surface thereof. After many trials I have found that a sapphire or other similar jewel co-operates in the most effective manner with the wax-like phonogram-blank since the acids thereof do not attack these substances, they are not rusted by moisture, and they are adapted to withstand the dulling action of the hard particles referred to.

The present invention consists in a cutting-tool (which may be either the recording-point or the turning-off tool) for a phonograph of a jewel or similar substance which will withstand the corroding action of acid and in certain combinations which will be hereinafter described and claimed.

The reproducer is not claimed herein, since it forms the subject of another application filed on even date herewith.

In the accompanying drawings, which illustrate the invention, Figure 1 is a side view, partly in section, of a phonograph of well-known form with the improved cutting-tools attached. Fig. 2 shows the recorder on a larger scale, and Fig. 3 is a view of a turning-off tool of slightly-different shape from that illustrated in Fig. 1.

1 is the wax-like phonogram-blank, mounted on a cylinder in the ordinary manner.

2 is the arm carrying the recorder and sleeved onto the guide-rod 3 and movable thereon.

4 is the guide-rest, on the upper edge of which the recorder-frame bears and along which it slides.

5 is a cam-lever for raising the frame and thereby removing the recorder from the surface of the blank.

6 is the recorder, preferably of sapphire, as above described. In the form shown the recorder is in the shape of a cylinder, the outer end being hollowed out, thus leaving a curved sharp edge for cutting the surface of the blank. This particular form does not constitute a part of the present invention, since it is claimed in my application, Serial No. 306,670, dated April 10, 1889. This cutting-tool is mounted in a socket or sleeve at one end of the pivoted lever 7, the opposite end of which is connected to the phonograph-diaphragm.

8 is a cutting-tool, which is technically termed the "turning-off" tool, and which is used for removing a previous record and for giving a smooth and even surface to the blank on which to impress a new record. This tool is also made of sapphire or of quartz, agate, or similar hard material not readily affected by the acids. In the construction shown it is clamped to the carrier 9, which is movable in the holder 10, and 11 is a handle for moving the cutting-tool onto or off from the surface of the blank.

I have found that a turning-off tool which does not have a sharp cutting-edge, but has such edge ground away to form a right angle or approximately a right angle, so that the

edge will not enter beneath the surface of the material, can be used to advantage. As such an edge cuts the material, it breaks it above the cutting-edge, so that the chips do not earry with them any portion of the blank below the line of cutting. This form of turning-off tool is illustrated in Fig. 3, where 8 is the sapphire cutting-tool supported in the clamp 12. This tool is supported, as indicated, so as to present its cutting-edge obliquely to the surface of the phonogram-blank.

Having thus described my invention, what I claim is—

1. In a phonograph employing phonogram-blanks of wax-like material, and in combination with a holder for such blanks, a jewel cutting-tool situated with relation to said holder, so as to operate upon the blank held thereby, substantially as set forth.

2. The combination, in a phonograph, with a phonogram-blank of comparatively-soft material, of a jewel recorder, substantially as described.

3. The combination, in a phonograph, with a phonogram-blank of a wax-like material, of a sapphire recorder, substantially as set forth.

This specification signed and witnessed this 24th day of May, 1890.

THOS. A. EDISON.

Witnesses:
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